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APPLIED

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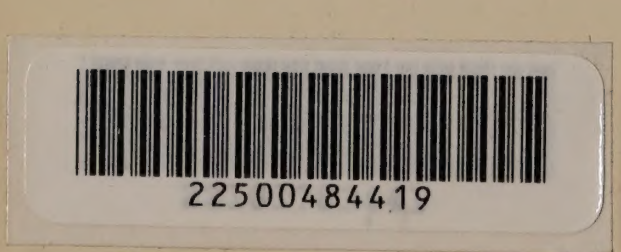

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AN AMERICAN TEXT-BOOK

OF

# APPLIED THERAPEUTICS

FOR THE USE OF

## PRACTITIONERS AND STUDENTS

EDITED BY

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# PREFACE.

THE extension of knowledge by research and the verification of facts by comparison and experiment are among the objects of the Medical Sciences; but the aim of Medicine is the application of knowledge to the prevention, cure, and alleviation of disease. This book, written from the standpoint of the practitioner, will contribute, it is hoped, to that aim. Its design is to facilitate the application of the results of the labors of the investigator to the uses of the practising physician.

The articles have been written by American contributors, with the exception of the article on Malaria by Professor Laveran, to whom the medical world owes so much for his discoveries in connection with that disease, and of that on Leprosy by Dr. Rake, whose uncompleted work in connection with that subject has already attracted widespread notice.

The list of contributors comprises the names of many who have acquired merited distinction as practitioners and teachers of practice, of clinical medicine, and of the specialties. The Editor desires to express his thanks for their hearty support and co-operation, and his appreciation of their work.

Two of the contributors—Beaven Rake of the Trinidad Leper Asylum, and William Cecil Dabney of the University of Virginia—have, since the work was begun, passed beyond the reach of thanks. Each died of acute disease in the full day of a life of unusual usefulness, with much already achieved, and the brightest promise of greater things. Their articles in this volume show better than any word of praise the sincere, thorough, and practical character of their professional work.

The arrangement of the book has been based, so far as this has been possible, upon modern pathologic doctrines, beginning with the intoxications, and following with the infections, diseases due to internal animal parasites, diseases of undetermined origin, and finally the disorders of the several bodily systems —digestive, respiratory, circulatory, renal, nervous, and cutaneous. It has been thought proper to include also a consideration of the disorders of pregnancy.

The endeavor throughout has been to conform to the title of the work—Applied Therapeutics—to indicate the course of treatment to be pursued at

the bedside rather than to name a list of drugs that have been used at one or another time. The thought has been invariably clinical and practical.

While the scientific superiority and the practical desirability of the metric system of weights and measures is admitted, it has not been deemed best to discard entirely the older system of figures, so that both sets have been given where occasion demanded.

Separate articles upon general therapeutic measures, such as hygiene, climate, quarantine, balneology, and the like, have been designedly omitted as not falling within the scope of the undertaking.

Matters of purely surgical interest have not been considered. In a few instances, however, some reference to the bearing of surgical treatment upon conditions under discussion has been necessary to complete the subject. A limited number of illustrations have been introduced to elucidate the text.

Notwithstanding the efforts of the Editor and the willingness of the contributors to limit the scope of their articles to purely practical matters, the work has grown considerably beyond the proportions originally intended—has in fact attained a bulk which would have rendered its publication in two volumes justifiable. A single volume has appeared, however, more convenient for reference.

The Editor assumes entire responsibility for certain departures from conventional modes of spelling that have been followed throughout the work, in most instances without comment on the part of the writers of the articles, in some with their approbation, and in two instances with acquiescence under protest after some friendly correspondence. It is believed that the orthographic forms referred to are in accordance with prevalent tendencies among scientific writers, and that they do no real violence to the spirit of the written language.

Dr. John B. Murphy of Chicago was kind enough to scrutinize the statistical data in Dr. Dabney's contribution dealing with the surgical treatment of cholelithiasis, and to make certain corrections in the figures in order to bring the statistics up to date.

Dr. Frank R. Smith of Baltimore translated the article of Professor Laveran.

The thanks of the Editor are due to Dr. Augustus A. Eshner for his skilful and untiring labor in seeing the work through the press, for assistance in many other details of its preparation, and for the making of the index; and to Dr. J. C. Rockafellow for statistics from the records of the German Hospital in Philadelphia.

J. C. WILSON.

1437 WALNUT STREET, PHILADELPHIA,
MAY, 1896.

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# AN AMERICAN TEXT-BOOK

OF

# APPLIED THERAPEUTICS.

## THE ACUTE POISONINGS.

By I. E. ATKINSON.

The conditions that determine the results of acute poisoning vary widely; they relate to the poisonous substance itself, as well as to the living body upon which it operates. Considering first the poison, we find that very much depends upon its degree of concentration; for example, sulphuric acid will very much more certainly cause death if taken undiluted into an empty stomach than when swallowed diluted and after eating. A non-corrosive poison taken under similar conditions will have similar results, the emptiness or fulness of the stomach determining the rate of absorption. This last is, again, modified by the nature of the gastric contents: if these consist in part of substances containing tannic acid, the absorption of some poisons, such as strychnin, morphin, and others, may be long delayed. On the contrary, phosphorus will be the more quickly absorbed if it meet in the stomach abundant fatty or oily matters. Or, again, a poison may be so changed chemically as to be completely neutralized by the gastric contents. A poison in solution or finely powdered may induce its effects more promptly than if undissolved or in large masses, or the contrary may obtain. Finally, the poison may excite such irritation as to induce vomiting and its rejection.

Conditions of the individual influencing the action of poisons are many; they depend upon age, sex, idiosyncrasy, habit, weight, rate of absorption and of elimination, and the state of the viscera and the tissues. As a rule, females are more susceptible, weight for weight, than are males. In some respects infants are more susceptible, proportionately, to some poisons than are adults; to others less so. Curious results of idiosyncrasy are occasionally observed, and death has been known to follow the administration of doses that are usually harmless. This idiosyncrasy cannot be foretold, and is revealed by personal experience. Habit, as is well known, modifies the action of drugs, and there are many of these to which persons may become so accustomed that enormous doses may be taken with impunity. Bodily weight is, of course, a modifying influence. Of two adults of the same sex and age,

the heavier should prove less susceptible to the dose—not absolutely, however, for of two adults of equal weight, the one fat, the other lean, the blood, organs, nervous system, muscles, etc. of the fat one will receive a larger share of the poison than will the same parts of the lean one. The relation of absorption and elimination to the action of poisons is most important. Strictly speaking, the dose of a drug given cannot be regarded as the amount actually acting upon the system. The actual dose is that quantity which is present within the tissues at one time. It is the amount less the quantity not yet absorbed and less the quantity already eliminated. The importance of this relation is evident, and is exemplified by Claude Bernard's well-known experiment, in which it was found impossible to poison animals by the deadly curare if it were introduced by the stomach, because the kidneys eliminated it as rapidly as it was absorbed, so that at no time could a poisonous quantity be present in the blood. Delayed absorption, as may occur from a disordered stomach, may prevent the toxic action of a drug, while toxicity may be increased by delayed elimination, as from diseased kidneys.

A universal antidote to poisons is, of course, out of the question. Attempts have been made to devise combinations of antidotes applicable to a wide range of poisons. To some extent these combinations may serve a useful purpose. As a general antidote for any poison of unknown nature a writer in the *Pharmaceutische Rundschau* recommends the following:

℞ Magnesiæ ustæ,
Carbonis ligni pulveris,
Ferri oxidi hydrati, partes æquales.

This mixture should be given freely, diluted with sufficient water. Murrell has proposed the following:

| | |
|---|---|
| Saturated solution of iron sulphate, | 100 parts; |
| Water, | 800 " |
| Calcined magnesia, | 88 " |
| Purified animal charcoal, | 40 " |

The iron-solution should be kept separate, and the magnesia and charcoal be mixed in a bottle with water. The two mixtures should be poured together when needed, thoroughly shaken, and given in wineglassful-doses *ad libitum.* With this mixture it is hoped to render inert arsenic, zinc, and digitalis, and to neutralize partially the action of mercury, morphin, and strychnin. Unfortunately, much general reliance cannot be placed on these composite antidotes, but in emergencies they may serve a useful purpose, and should be kept upon the shelf of the pharmacist.

### The Mineral Acids.

The strong mineral acids, when taken undiluted, are poisonous even in the smallest doses; they corrode and cauterize living tissue as long as any uncombined acid remains in contact with it. When taken into the mouth by mis-

take the individual may become aware of his error before more than a few drops have been introduced, or he may discover it before attempting deglutition, and may escape with no more than a local, though perhaps very disastrous, cauterization. The acid is not likely to reach the gullet unless it is swallowed with suicidal intent or hastily. A small quantity, say ½ dram (2.), will hardly reach the stomach in quantity sufficient to do serious injury to that organ: it will probably combine entirely with the tissues of the upper alimentary tract, exciting, possibly, fatal edema of the glottis or intense pain and suffering, with swelling, sloughing, ulceration, and subsequent cicatricial contraction. The fatal dose of a strong mineral acid varies with the acid and the conditions of its ingestion. Quite large doses may fail to destroy life if the acid be diluted when swallowed or if the stomach be full at the time. Strong nitric acid will usually prove fatal in doses of about 2 fluidrams (8.), though recovery has followed the ingestion of ½ fluidounce (16.) (Murrell). Hydrochloric acid is less powerfully corrosive, though a fluidram (4.) is said to have proved fatal. A fluidounce (30.) has been swallowed without destroying life. Similarly with sulphuric acid, which is intensely corrosive: while a few drops may kill, as much as a fluidounce (30.) has been known to fail of a like result. Phosphoric acid is fatal in about the same doses as the others. Evidently the result will depend not only upon the degree of concentration of the acid, but also upon the condition of the stomach and its contents and upon the results of treatment. As the poisonous action of acids is one of chemic combination with bases present in the tissues, it is of the utmost importance that treatment should be begun without delay. The administration of antidotes is a matter with which the public should be acquainted, as in most cases there remains little or no uncombined acid in the stomach upon the arrival of the physician.

When the poisoning is discovered, the patient should at once be made to swallow large quantities of non-corrosive alkaline solutions. The alkali almost always at hand is ordinary baking-soda, sodium bicarbonate. This may be swallowed freely in concentrated solution, preferably in milk. Potassium bicarbonate, chalk, magnesia, diluted solutions of washing-soda, sodium carbonate (alkaline carbonates themselves are poisonous in large doses), ammonia, and in an emergency plaster scraped from the wall or the fence, strong soapsuds, and milk or beaten eggs, are all effective. The point is not to select the most effective antidote, but the one that can be obtained most speedily. After a sufficient quantity of the antidote has been administered, the stomach may be emptied gently with the esophageal tube, *not the stomach-pump*, as rough handling may complete an impending perforation of the stomach-walls. As the immediate danger is from the local action of the acid, after its neutralization by the antidote it is not a matter of vital importance that the stomach be emptied, and usually it will be best to keep the patient absolutely quiet and not attempt to unload it, even by means of an emetic. If it be thought advisable to administer an emetic, it should be an unirritating one, such as ipecacuanha. If the action of the acid or of its fumes has induced edema or spasm of the glottis, and death from asphyxia be imminent, an immediate

tracheotomy may be necessary to preserve life. After the antidote bland oleaginous or mucilaginous liquids should be given, to allay the intense irritation of the corroded surfaces. For this purpose one may use olive-oil, linseed-oil, cottonseed-oil, or oil of sweet almonds, or flaxseed-tea or slippery-elm tea or mucilage. The organs of deglutition and the stomach should be kept absolutely at rest as regards both food and medicine. Hypodermic injections of morphin will control intense pain and, often, shock. From $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.0081–0.016) may be given, and repeated once or twice at intervals of a half-hour if necessary. Stimulants should be given by enema, and if there be profound collapse, artificial heat should be applied to the trunk and extremities. Warm fomentations to the epigastrium will allay the pain to some extent. Should the patient survive for several days, nutrition ought to be maintained by rectal enemata, and when the stomach becomes able to receive and to retain food, this should be of a liquid character—milk, simple broths, egg-nog, etc.

The subsequent treatment is that of acute inflammation of the upper alimentary tract.

### The Vegetable Acids.

Tartaric acid, glacial acetic acid, and oxalic acid are poisonous when doses of considerable size are taken. Oxalic acid is the most powerful, and death has been known to follow the ingestion of 1 dram (4.). The treatment of poisoning by these acids is similar to that of poisoning by the mineral acids, excepting that alkaline carbonates should be avoided. Lime-water or the syrup of lime is best, though chalk and magnesia and its acid carbonate are also antidotal. After the antidote has been given the stomach may be emptied by an unirritating emetic (ipecac), but the stomach-pump should not be employed. Pain and shock are to be controlled by hypodermic injections of from $\frac{1}{8}$ to $\frac{1}{4}$ grain (0.0081–0.016) of morphin sulphate and by bland demulcent drinks. Depression and collapse require artificial heat to the trunk and extremities, and stimulants given by enema or hypodermically.

### Alkalies.

**Caustic Potash** (Potassium hydroxid); **Caustic Soda** (Sodium hydroxid); **Caustic Lime** (Calcium hydroxid); **Stronger Ammonia** (Ammonium hydroxid); **Potassium Carbonate**; **Sodium Carbonate.**—The fatal dose of a caustic alkali is probably about 40 grains (2.5). The most common source of alkali-poisoning is concentrated lye, a solution of caustic soda used for washing. Death has been caused by 1 dram (4.) of stronger ammonia and by $\frac{1}{2}$ ounce (16.) of potassium carbonate. It may occur within a few hours, from the primary effects, but days, weeks, or months may elapse before life is destroyed by the secondary effects. As the poisoning depends upon the corrosive properties of the alkalies, treatment, to be effective, must be immediate. Dilute vegetable acids should be administered. These acids are readily supplied in lemon-juice, vinegar, or the juice of acid fruits, which will neutralize the poison. Bland oils—olive-oil, cottonseed-oil, and sweet-almond oil—are

antidotal, forming soaps with alkalies. Milk or cream or butter may be given with great advantage. The vapor of ammonia may destroy life without being swallowed. Its powerful fumes excite sudden spasm of the upper respiratory apparatus and edema of the glottis, and thus fatal asphyxia. Timely tracheotomy may prove effective under such conditions. Inhalation of the fumes of acetic acid or of hydrochloric acid has been recommended, but favorable effects can hardly be expected from such treatment. Demulcent drinks should follow the administration of the antidote. Egg-water, barley-water, gum-water, and olive-oil all tend to allay the irritation. These should be given freely, and emesis may be encouraged by copious drafts of warm water or by mustard and water or ipecac. The same caution is to be observed regarding the use of the stomach-pump as in poisoning by the mineral acids. Evacuation of the stomach will be required or not according to the amount of poison taken or the character and amount of the antidote given. It should be remembered that fatal results from poisoning by alkalies are as frequent from secondary as from primary effects. The former include inflammation, septic infection, and cicatrization in the mouth, esophagus, or stomach. They must be treated according to their special indications. Pain must be controlled by opiates and hot fomentations.

### Mercuric Chlorid

(Corrosive sublimate; Hydrargyri chloridum corrosivum).—From 3 to 5 grains (0.19–0.32) may be considered a fatal dose for an adult, but recovery has been known after as much as 1 ounce (32.) had been taken, the stomach having been full at the time, and treatment promptly instituted. Egg-albumin is the most effective antidote to corrosive-sublimate poisoning. The uncooked white of egg should be given at once and freely. It is usually reckoned that the white of one egg is capable of converting 4 grains (0.26) of corrosive sublimate into a non-corrosive albuminate. The resulting albuminate, however, may still be absorbed and produce acute systemic mercurial poisoning. Therefore, even if spontaneous emesis have been induced, the stomach should be washed out again and again, preferably through an esophageal tube, as rough handling with the stomach-pump may cause perforation. To destroy any of the poison that may remain, egg-albumin should be given in the intervals of washing or of emesis. If neither the tube nor the stomach-pump is at hand, vomiting should be induced by mustard (a tablespoonful in half a cupful of warm water), ipecac (half a dram (2.) of the powder or a teaspoonful of the wine), or zinc sulphate (10 grains (0.65) in 1 ounce (30.) of water). If egg-albumin cannot be had, milk may be given, or wheaten flour—unbolted flour if it can be obtained. After the antidote has been given in sufficient quantity and the stomach has been emptied thoroughly, demulcent drinks—flaxseed-tea and bland oils—will soothe the irritated surfaces. While special antidotal treatment is being carried out, stimulants will be needed to overcome the profound depression of the general system, and opiates to control pain and allay nervous irritability. These agents must be given, not by the stomach, but hypodermically or by the rectum. The subsequent treatment is

one of support, but for several days both remedies and food should be administered by enema. Should the patient survive, he may develop the symptoms of mercurial poisoning; and in cases in which the poison has been administered in toxic but not immediately fatal doses he is pretty sure to do so. The ordinary treatment for acute mercurialism will then be appropriate.

### Other Metallic Salts.

**Copper Sulphate** (Bluestone; Cupri sulphas); **Zinc Sulphate** (White vitriol; Zinci sulphas); **Lead Acetate** (Sugar of lead; Plumbi acetas); **Silver Nitrate** (Lunar caustic; Argenti nitras); **Zinc Chlorid** (Zinci chloridum).—The fatal dose of copper sulphate for an adult is from ½ ounce (16.) to 1 ounce (32.); of zinc sulphate, about ½ ounce (16.); of lead acetate, from ½ ounce (16.) to 1 ounce (32.). A child has been fatally poisoned by swallowing part of a stick of lunar caustic broken from a *porte-caustique*.

Poisoning by these metallic salts should be treated very much as that by corrosive sublimate. White of egg or milk should be given freely and the stomach be emptied by emesis or the stomach-tube, and the process should be repeated several times. Of course, the result will depend much upon the concentration of the poison when swallowed. If silver nitrate have been taken, a strong solution of table-salt should be given, to form an insoluble silver chlorid. If zinc chlorid have been the poison, solutions of sodium or potassium carbonate should be given—with care, however.

After emptying the stomach several times demulcent drinks should be given, warm poultices applied to the epigastrium, and opiates administered. Food or medicine should not be given by the stomach.

### Arsenic.

Alarming symptoms may be caused by as small a dose as ½ grain (0.032) of arsenous acid. A dose of from 2 to 3 grains (0.13–0.19) will usually prove fatal for an adult, though recovery has followed after ½ ounce (16.) had been swallowed when the stomach was full and treatment was begun at once. (The official solutions of arsenic contain each 1 grain (0.065) in 100 minims —6.16.) Death may occur as early as twenty minutes, or not until several days, after the ingestion of the dose. In favorable cases recovery may be very tardy.

When a poisonous dose of any arsenical preparation has been swallowed, the stomach should be washed out at once and repeatedly with the stomach-pump or through the esophageal tube. If these be not at hand, emetics should be given, such as mustard-flour, a tablespoonful in a gill (120.) of hot water, or a strong solution of table-salt in hot water. More effective, though not always available, emetics are copper sulphate and zinc sulphate.

℞ Cupri sulphatis, gr. xij (0.78);
Aquæ, f℥ij (60.).—M.
Sig. Give a tablespoonful every few minutes until free vomiting is induced.

Or,

℞ Zinci sulphatis, gr. xx (1.3);
Aquæ, f℥ij (60.).—M.

Sig. Give a teaspoonful every few minutes until free vomiting is induced.

Or a single dose of 10 grains (0.65) of copper sulphate or of 20 grains (1.3) of zinc sulphate may be given, dissolved in 2 or 3 fluidounces (60.–90.) of water.[1] While these measures are being pursued the proper antidote to arsenic should be made ready. This is hydrated iron oxid, or, better, hydrated iron oxid with magnesia. These preparations should always be made freshly, and to avoid delay their ingredients should be ready for admixture in all pharmacies and in the offices of country practitioners. The ferric hydrate with magnesia may be prepared with the least delay and in the following manner:[2]

"Solution of ferric sulphate, 50 c.c. (f℥xijss);
Magnesia, 10 grams (℥ijss);
Water, a sufficient quantity.

Mix the solution of ferric sulphate with 100 c.c. (f℥iijss) of water, and keep the liquid in a large, well-stoppered bottle. Rub the magnesia with cold water to a smooth and thin mixture; transfer this to a bottle capable of holding about 1000 c.c. (Oij), and fill it with water to about three-fourths of its capacity. When the preparation is wanted for use, shake the magnesia-mixture to a homogeneous, thin magma, add it gradually to the iron-solution, and shake them together until a uniform smooth mixture results."

This mixture may be administered freely. It converts the arsenic in the stomach into an insoluble iron arsenate. *It only combines with arsenic in solution, and therefore should be given repeatedly after each act of vomiting or each washing of the stomach, until it is reasonably certain that no more of the arsenic remains.* Iron subcarbonate has been employed successfully when large doses of arsenous acid or of Paris green had been swallowed.[3] Dialyzed iron enjoys some reputation as an antidote in acute arsenical poisoning, and is readily obtainable. Recent observation, however, does not show its merit to be great. It may be given freely in doses of 1 fluidounce (30.). As soon as the stomach has been cleared of its poisonous contents a fluidounce (30.) of castor-oil should be given, to relieve the intestines of any arsenic that may have passed into them, and at the same time demulcent drinks and bland oils should be given freely. The iron-antidote is useless to antagonize the influence of arsenic that has been absorbed: physiologically it is not an antidote at all; indeed, there is no known physiologic antidote to this poison, and to combat its systemic effects brandy, whisky, ammonia, and diffusible stimulants generally should be given as required—

[1] When the patient refuses to swallow, from $\frac{1}{10}$ to $\frac{1}{6}$ grain (0.0065–0.011) of apomorphin hydrochlorate should be injected under the skin, and again in twenty minutes if necessary.

[2] United States Pharmacopeia, 1890, p. 191.

[3] Teale (quoted by Wormley): *American Journal of the Medical Sciences*, Jan., 1880, p. 80.

not by the stomach, unless thoroughly diluted, but preferably by the rectum or subcutaneously. The intense pain and the cramps of acute arsenical poisoning must be treated with hypodermic injections of morphin and the application of hot fomentations to the epigastrium and abdomen. Cramps and coldness of the extremities may be controlled by massage and the application of artificial heat.

### Phosphorus.

The usual sources of phosphorus-poisoning are rat-pastes, vermin-pastes, and the heads of friction-matches. Although as little as $\frac{1}{8}$ grain (0.0081) of white phosphorus is said to have caused death (Taylor, Wormley), the fatal dose for an adult is probably about 1 grain (0.065). Recovery from pronounced phosphorus-poisoning is rare, though it has been known to follow a dose of 5 grains (0.32). The fatal result usually occurs in from one to five days; it has been known to take place in twelve hours, and as late as the seventh, even the twelfth, day.

Whether vomiting have occurred or not, an emetic of copper sulphate should be given at once, either in a single dose of 10 grains (0.65) in solution or in doses of 2 or 3 grains (0.13–0.19) every five minutes until free vomiting be induced. The copper sulphate not only acts as the most prompt emetic, but it is a chemic antidote to phosphorus; and as this drug is slowly dissolved in the stomach and is slowly absorbed, it would be proper to continue to give the copper in 1-grain (0.065) doses every fifteen minutes, combined with morphin to control its emetic properties. In the stomach the undissolved phosphorus becomes blackened immediately from contact with the copper, copper phosphid being formed. Until the copper sulphate can be obtained, other emetics should be employed—zinc sulphate in 20-grain (1.3) doses, wine of ipecac in $\frac{1}{2}$-ounce (15.) doses, or even mustard. Apomorphin hydrochlorate in $\frac{1}{6}$-grain (0.011) doses every fifteen minutes may be given subcutaneously. Calcined magnesia has been supposed to neutralize any phosphorus oxid in the stomach, and copious drafts in a demulcent liquid may be given. Its value, however, is doubtful. Oils and fats should be avoided, as phosphorus readily dissolves in them. The salvation of the patient depends upon evacuation or neutralization of the phosphorus before its absorption, as no treatment is known whereby the degeneration of the tissues caused by it can be averted. As soon, therefore, as free vomiting has taken place, administration of *acid French turpentine* should be resorted to, one part of the turpentine being given for every hundredth part of phosphorus (Wood). More generally, 2 fluidrams (7.5) of the turpentine in suspension in mucilage should be given every ten minutes for four doses. This acid French turpentine forms with phosphorus a spermaceti-like mass, phospho-terebinthinic acid, which is quite harmless. The ordinary American turpentine and Canada balsam are quite valueless for the purpose. It is said that ordinary turpentine which has become ozonized by long exposure to the air is also effective. It should be tried if the acid French oil cannot be obtained. Particles of undissolved phosphorus may pass into the intestines, and, indeed, have often been voided with the feces; a prompt pur-

gative should therefore be given. Castor-oil is inadmissible, but magnesium sulphate or sodium and potassium tartrate or other saline purgative may be given in large doses.

As there is no physiologic antidote to phosphorus-poisoning, specific treatment is restricted to the use of chemic antidotes before absorption. The tissue-degeneration resulting from the presence of phosphorus in the system must be combated by generally supporting treatment, but the result will almost always depend really upon the amount of the poison that has been absorbed.

### Antimony.

Tartar emetic is almost always the preparation of antimony encountered as a cause of poisoning. The usual fatal dose is from 10 to 20 grains (0.65–1.3). A debilitated child has been killed by ¾ of a grain (0.049), and an adult by 2 grains (0.13). On the contrary, recovery has followed a dose of 1 ounce (32.). Antimonial wine contains 2 grains (0.13) of tartar emetic to the fluidounce (30.), and the compound syrup of squill (Coxe's hive-syrup) about ¾ of a grain (0.049) to the fluidounce (30.). Death has occurred as early as three-quarters of an hour after the fatal dose, but it is usually deferred for a number of hours.

Free vomiting will almost always have occurred before the arrival of a physician, but as tannic acid is the most potent antidote, the stomach should be washed out repeatedly with a solution of the acid or of one of the vegetable astringents. Strong tea and coffee are always available. In some rare cases of tartar-emetic poisoning vomiting does not occur. It may then be necessary to use other emetics. Other things being equal, it is better not to employ the irritating emetics; 30 grains (2.) of powdered ipecac, ½ ounce (15.) of the wine or syrup, or 1 tablespoonful of mustard-flour in hot water may be given by the stomach, or ⅙ grain (0.011) of apomorphin hydrochlorate may be injected subcutaneously; but, if possible, preference should always be given to the stomach-pump or the esophageal tube. After the stomach has been emptied thoroughly, white of egg, gum-water, flaxseed-tea or other demulcent, or even milk, should be drunk. The patient should be rubbed dry and be enveloped in blankets and have artificial heat applied to his extremities. The deep physical depression must be controlled by diffusible stimulants—brandy, whisky, camphor, hot coffee, and, after the stomach is quite free from all traces of the poison, morphin should be injected subcutaneously. As there is no physiologic antidote to tartar-emetic poisoning, specific treatment must be limited to the neutralization and evacuation of the drug before absorption. The treatment of symptoms resulting from the absorbed poison must be stimulant, supporting, and anodyne. Food in small quantities and in liquid form will usually be borne by the stomach after the more acute gastric symptoms have subsided.

### Chloral Hydrate.

The fatal dose of chloral hydrate varies within wide limits: 30 grains (2.) have caused death, while recovery has occurred after 460 grains (30.) were

swallowed. Death may ensue as early as in three hours, but it usually occurs much later.

The stomach should in all cases be emptied at once by the stomach-pump or through the esophageal tube. This method is preferable to the use of emetics, as under the influence of chloral the act of vomiting is sometimes very difficult of excitation. It may, however, be necessary to use emetics. One may give copper sulphate, 10 grains (0.65) in solution, or zinc sulphate, 20 grains (1.35) in solution, or 30 grains (2.) of powdered ipecac, or ½ ounce (15.) of the syrup or wine, or a tablespoonful of mustard-flour in warm water, or other emetic. Cocain hydrochlorate in doses of $\frac{1}{6}$ grain (0.011) may be injected hypodermically. Emesis should be encouraged repeatedly, to secure complete emptying of the stomach, or successive washings of the stomach should be practised. In chloral-poisoning the temperature of the body is steadily lowered. This tendency should be combated by keeping the temperature of the apartment high, by the application of artificial heat to the body and the extremities, and by enveloping the patient in warm blankets. Vigorous friction and massage should be practised. The patient should be aroused by strong counter-irritation, friction, slappings, pinching, etc. The faradic battery may be applied to the chest. Everything must be done to support and stimulate the cardiac and respiratory centers, but one must be careful to avoid the exhaustion and exposure of active exercise. To stimulate respiration the vapor of ammonia should be applied to the nostrils, and in desperate cases artificial respiration must be resorted to and, if necessary, be maintained for hours. The claim of Liebreich that strychnin is a physiologic antidote to chloral has found some supporters. Strychnin sulphate may be given hypodermically in doses of $\frac{1}{50}$ grain (0.0013) repeated at intervals of fifteen minutes until $\frac{1}{12}$ grain (0.0054) has been given. Physostigmin is thought by some to be antidotal in doses of $\frac{1}{12}$ grain (0.0054). Valuable support may be had from rectal injections of strong coffee—from ½ pint (250.) to 1 pint (500.), injected slowly and retained by pressure against the anus.

### Hydrocyanic Acid; Prussic Acid; Potassium Cyanid.

The fatal dose of anhydrous hydrocyanic acid may be as small as 1 grain (0.065), or of the dilute hydrocyanic acid (U. S. P.) 50 minims (3.); 5 grains (0.32) of potassium cyanid have caused death. Recovery has followed the swallowing of 2½ grains (0.16) of the anhydrous acid. If the patient survive the ingestion of the poisonous dose a half-hour, he will probably recover. In fatal cases death usually occurs within from five to ten minutes, sometimes earlier. It has been known to occur within two minutes or perhaps sooner, but the frequently repeated assertion that it may occur instantaneously is incorrect.

The treatment of hydrocyanic-acid poisoning can rarely be effective, on account of both the rapidity of action and the inefficiency of antidotes. It has been claimed by Preyer that atropin is a physiologic antidote. At all

events, from $\frac{1}{30}$ to $\frac{1}{15}$ grain (0.0022–0.0043) of atropin sulphate may be injected subcutaneously at once. Then vomiting should be induced by tickling the fauces or by a prompt emetic, such as copper sulphate, 10 grains (0.65) dissolved in 1 or 2 ounces (30.–60.) of water, or zinc sulphate, 20 grains (1.3) dissolved in 1 or 2 ounces (30.–60.) of water. If the apparatus be at hand, the stomach-pump or the stomach-tube should be resorted to, and the stomach be washed out repeatedly until the odor of the acid can no longer be perceived. Cold affusions seem to have given the best results, and they should always be employed. The water may be poured from a height upon the head, neck, and trunk. It has been asserted that the vapor of ammonia and that of chlorin have valuable chemic antidotal properties. Active stimulation with whisky, ammonia, and ether should be practised as freely as possible. These should be given subcutaneously, the stronger water of ammonia diluted with three times its bulk of water. The per-salts and proto-salts of iron with magnesia have also been recommended as chemic antidotes, but the action of hydrocyanic acid is too rapid to permit of their timely preparation and use. In all cases artificial respiration should be maintained as long as life lasts.

Poisoning by potassium cyanid should be treated identically as that produced by hydrocyanic acid.

### Carbolic Acid; Creosote.

Carbolic acid is both a corrosive and a specific poison. The fatal dose to an adult will vary from 1 fluidram (4.) to $\frac{1}{2}$ fluidounce (15.) (the latter dose pretty certainly). It is difficult to determine exactly the fatal dose. Doubtless, when undiluted carbolic acid is taken into the stomach a considerable amount is used up in chemic combination with the tissues. The quantity sufficient to destroy life by its specific poisonous action must be quite small, as is sometimes shown by the poisoning that results from its local application as a dressing for wounds and burns and from its injection. A fluidram (4.) of the diluted acid would prove fatal more certainly than would a dram (4.) undiluted.

The symptoms, specific as well as corrosive, appear almost immediately. Taylor[1] has reported a case in which a man fell unconscious ten seconds after swallowing an ounce (30.), and was dead in less than a minute. Usually the symptoms develop within a few minutes, and in fatal cases death occurs within an hour or two, although it may be deferred eight, ten, twelve, or even forty-eight hours. In view of this rapid action, one should endeavor to neutralize the acid by means of a chemic antidote before attempting to remove the poison from the stomach. For this purpose a soluble sulphate should be employed—magnesium sulphate (Epsom salt) or sodium sulphate (Glauber's salt) dissolved in water in the proportion of 1 ounce (32.) to 1 pint (500.). The sulphate converts the carbolic acid into a sulphocarbolate, which is not harmful. The solution should be given freely. In carbolic-acid poisoning the stomach is very irresponsive to the action of emetics, and, though one may inject hypo-

[1] *Philadelphia Medical Times*, vol. ii.

dermically from $\frac{1}{6}$ to $\frac{1}{4}$ grain (0.011–0.016) of apomorphin hydrochlorate, or give by the mouth a tablespoonful of mustard stirred into a cupful of warm water, or from 10 to 20 grains (0.65–1.3) of zinc sulphate or from 2 to 10 grains (0.13–0.65) of copper sulphate dissolved in water, it is better to have recourse, immediately after giving the chemic antidote, to the stomach-pump or the esophageal tube. After removing its contents the stomach should be flushed again and again with the sulphate-solution until the odor of carbolic acid shall have disappeared from the returned fluids. The cauterized mucous membrane should be treated with egg-albumin or with mucilaginous drinks.

Saccharated lime has been used largely as a chemic antidote to carbolic-acid poisoning. Its preparation demands a longer time than the exigencies of acute carbolic-acid poisoning permit, and, unless kept already prepared in the shops, it is hardly available. Wood gives the following formula for it: Dissolve 16 parts of sugar in 40 parts of distilled water, and add 5 parts of caustic lime; digest for three days, stirring from time to time; filter and evaporate to dryness. The product thus obtained dissolves freely in water. If the poison have been absorbed from a wounded surface or a burn or from a cavity into which it may have been injected, these measures are useless, and attention must be given at once to the systemic condition. Bartholow considers atropin a physiologic antidote to carbolic acid. This property was first observed by Dr. Post of New York. Hypodermic injections of $\frac{1}{60}$ grain (0.0011) of the sulphate may be repeated at intervals of twenty minutes for four doses. Murrell has suggested inhalations of amyl nitrite, and in desperate cases venesection followed by transfusion. Artificial heat should be applied to the trunk and the extremities, and vigorous friction be practised. Stimulants—whisky, brandy, compound spirit of ether in water—will always be indicated. They are best given by rectal or hypodermic injection. Should the patient survive the specific poisonous effects, one will still have to contend with the irritant and caustic effects. These will be similar to those of the irritant corrosive poisons, and if extensive may of themselves prove fatal. The course, termination, and treatment agree with those of ordinary corrosive poisoning.

## Poisonous Gases.

**Illuminating Gas** (Coal-gas; Water-gas); **Sewer-gas**; **Cesspool-gas**; **Carbon Dioxid** (Carbonic-acid gas; Choke-damp).—The patient should be brought out at once into the fresh air, or, the escape of gas into the room or vault having been prevented, all doors and windows should be thrown widely open. Respiration should be stimulated by the faradic current applied approximately along the course of the phrenic nerve, or in extreme cases it may become necessary to resort to artificial respiration. The vapor of ammonia should be applied to the nostrils cautiously, and when practicable inhalations of pure oxygen should be instituted without delay. Alcohol, ether, or ammonia should be given by the mouth or rectum or subcutaneously. Vigorous friction of the limbs should be practised. Cold and warm water alternately should be dashed over the head and trunk. In some cases general blood-

letting has seemed to give excellent results, though in others it has done no good. Transfusion after venesection has yielded brilliant results at the hands of some physicians. In desperate cases it is a procedure of great promise. Very deceptive appearances of improvement may encourage the attendants to relax their efforts too soon. Prolonged watchfulness and activity are always required, as relapse may occur after apparent resuscitation.

### Aconite; Monkshood.

Aconite-root has been eaten in mistake for horse-radish, which it resembles. Alarming symptoms have been caused by 5 drops of the fluid extract or 12 drops of the tincture; 4 grains (0.26) of the extract have proved fatal, and in a number of cases 1 fluidram (4.) of the tincture has killed. Aconitin is of very uncertain strength as found in the shops. Petit's aconitin was found by Plugge to be eight times as strong as that of Merck (Wood): $\frac{1}{16}$ grain (0.0041) of the former has produced death. Several grains of impure aconitin have been recovered from. A frequent source of poisoning is liniments containing tincture of aconite. According to Reichert, the average time of death after swallowing the poison is three and a half hours, but it has occurred as early as eight minutes (Mallet) and thirty minutes (Wood). Should the patient live five or six hours, he will probably recover.

If the poison has been swallowed, the stomach should be emptied thoroughly by washings with water through the stomach-pump or an esophageal tube worked as a siphon. If these agents cannot be had, emetics must be employed, but their use is always dangerous, as they increase the tendency to fatal syncope by the active movement they excite. During their action the patient should be kept in the recumbent posture. A tablespoonful of mustard in a half-cupful of warm water may answer, but it is better to give a more prompt emetic, such as zinc sulphate, gr. xx (1.3) in a gill (120.) of water, or copper sulphate, gr. ij, v, or x (0.13, 0.32, 0.65) in warm water, repeated in five minutes if necessary. Should the patient be unable or refuse to swallow, gr. $\frac{1}{6}$ (0.011) of apomorphin hydrochlorate may be injected hypodermically. Before the stomach has been emptied large quantities of finely powdered animal charcoal may be given; or copious drafts of liquids containing tannic acid—tea, coffee, vegetable astringents—may be drunk. These should be removed as soon as practicable, as the absorption of the poison is only delayed, and not prevented, by their action.

Several agents enjoy reputation as physiologic antidotes to aconite. Probably the most important is belladonna or its alkaloid, atropin. At intervals of fifteen minutes for three doses, gr. $\frac{1}{60}$ (0.0011) of atropin sulphate may be injected under the skin. Should improvement not follow, digitalis should be resorted to. If it can be retained, 1 fluidram (4.) of the tincture may be given by the stomach and repeated in an hour; or the drug may be given subcutaneously (♏xv (1.) of the tincture or ♏iv (0.25) of the fluid extract). Nux vomica is also useful to support a failing heart. Gr. $\frac{1}{25}$ (0.0026) of strychnin sulphate may be given hypodermically and repeated in a half-hour.

After the stomach has been thoroughly washed out, stimulants must be

resorted to. Alcoholic liquids should be given by the rectum or subcutaneously, or, if practicable, by the mouth. Ammonia is also very valuable: ℥xx (1.23) of aqua ammoniæ diluted with three times its bulk of water should be injected subcutaneously. Artificial heat should be applied to the trunk and the extremities, and the patient be enveloped in warm wraps and blankets. In extreme cases Murrell recommends inhalations of amyl nitrite. If symptoms of asphyxia become pronounced, it will be necessary to resort to artificial respiration.

### Belladonna; Atropin.

Fatal belladonna-poisoning is not common. However, cases are not rarely encountered of mild intoxication from large medicinal doses, from the plaster of belladonna, or from instillations of solutions of atropin. Death from such small doses as gr. $\frac{1}{12}$ (0.0054) or even gr. $\frac{1}{30}$ (0.0022) of atropin sulphate must be exceedingly uncommon; gr. ij (0.13) more probably constitute a fatal dose for an adult, though Murrell has reported the recovery of a child aged two years from gr. j (0.065) of atropin. The fatal result may occur within a few hours or it may be deferred for twenty-four hours or more. Comparatively small doses of belladonna or atropin may induce very alarming and most unpleasant symptoms.

If the poisonous dose have been swallowed, a large quantity of tea or coffee or other tannic-acid-containing liquid should be drunk at once, to delay absorption, and the stomach should immediately be washed out with the stomach-pump or with the esophageal tube used as a siphon. The action of emetics is most unsatisfactory on account of the attendant obtunding of reflex sensibility. Nevertheless, in the absence of efficient means of emptying the stomach they must be resorted to. One may give every five minutes, until emesis occurs, a tablespoonful of mustard in a cupful of hot water; or 20 grains (1.3) of zinc sulphate or 10 grains (0.65) of copper sulphate in a gill (120.) of water at a dose. It is often better to give the emetic in smaller doses at short intervals; thus, 5 grains (0.32) of zinc sulphate or 2 grains (0.13) of copper sulphate every five minutes until the desired result is obtained. If swallowing be impossible, $\frac{1}{6}$ grain (0.011) of apomorphin hydrochlorate may be injected under the skin, and again in twenty minutes if necessary. Opium is undoubtedly antidotal, and may be administered at once and quite freely. Hypodermic injections of $\frac{1}{4}$ grain (0.016) of morphin sulphate may be given every half-hour for three doses. Very large doses of morphin have been given in atropin-poisoning without disadvantage. In one case in which 1 grain (0.065) of atropin had been taken, from 16 to 18 grains (1.04–1.17) of morphin were given hypodermically without producing any manifestations of morphin-poisoning. Pilocarpin has also yielded excellent results in belladonna-poisoning. Murrell advises the hypodermic injection of $\frac{1}{2}$ grain (0.032) of the nitrate, repeated several times. Physostigmin salicylate has also been used as an antidote in doses of from gr. $\frac{1}{16}$ (0.0041) to gr. $\frac{1}{12}$ (0.0054). It will often be necessary to give brandy or whisky in liberal doses. Counter-irritation to

the extremities and artificial heat may also be applied. The patient should be aroused by slapping the surface, by vigorous flicking with wet towels, by alternating cold and hot affusions, and by various measures tending to stimulate nervous activity. To remove atropin that has been eliminated by the kidneys, the use of the catheter will be indicated. Artificial respiration may become necessary.

### Cocain.

The toxic dose of cocain varies within wide limits. Alarming symptoms have been produced by as little as gr. $\frac{1}{4}$ (0.016), while more than gr. xv (1.) has been taken without discomfort. Death has been caused by doses of from gr. $\frac{2}{3}$ to gr. j (0.043–0.065). It may occur within a few moments after subcutaneous administration; usually several hours elapse before the fatal issue. Cocain hydrochlorate is rapidly absorbed from all mucous surfaces.

If the poisonous dose have been swallowed and the patient is seen early, the stomach should be thoroughly emptied by means of the stomach-pump or esophageal tube, or by a prompt emetic, such as mustard or copper or zinc sulphate. In combating the effects of the poison the essential objects should be to sustain the circulation and respiration and to diminish reflex irritability. The patient should be kept in the recumbent posture and diffusible stimulants administered; of these, alcoholic fluids, strong black coffee, and ammonia-water are the best. Of strychnin sulphate gr. $\frac{1}{50}$ (0.0013) may be injected hypodermically every half-hour for three doses, in alternation with gr. iiss (0.16) of caffein. The marked general arterial anemia will be most effectually overcome by nitroglycerin and amyl nitrite. If convulsions, with tetanic rigidity of the respiratory muscles, occur, chloroform should be given by inhalation. Threatened asphyxia should be met by frictions, flagellations, faradization, and even artificial respiration. Vigorous friction of the extremities and active counter-irritation with mustard or turpentine will further stimulate the circulation. For profound depression and collapse artificial heat will be required. The patient should be watched closely for many hours, as apparent improvement is often followed by sudden failure.

### Nux Vomica; Strychnin.

One-half dram (2.) of powdered nux vomica is said to be a fatal dose, and it has been asserted that 3 grains (0.19) of the extract have caused death. Of strychnin sulphate $\frac{1}{2}$ grain (0.032) has destroyed an adult. Doses of from 2 to 3 grains (0.13–0.19) are usually fatal. Alarming symptoms may follow a dose as small as $\frac{1}{12}$ grain (0.0054). According to H. C. Wood, $\frac{1}{100}$ grain (0.00065) has killed a child three and a half months old. On the contrary, recovery has followed the swallowing of 30 grains (2.) of strychnin sulphate. Much depends upon the state of the stomach—if it be full or empty, if it contain tannic acid, or if vomiting have taken place. Death has occurred in five minutes after the onset of symptoms, or in ten minutes after the ingestion of the poison. It may be delayed one hour, two hours, even eighteen hours. The symptoms may be much retarded in their appearance. Usually

they do not appear earlier than fifteen minutes or later than an hour, but they have been known to occur in three minutes and to be deferred for several hours, especially when the poison has been taken in combination with tannic acid or opium.

If the patient be seen at once after swallowing the dose, a copious draft of strong tea or coffee or other vegetable astringent should be administered, and the stomach should be washed out with the stomach-pump or the esophageal tube. Repeated washings should be practised, as the undissolved alkaloid is likely to adhere closely to the mucous membrane of the stomach. A solution of tannic acid, if it is to be had, is preferable to other astringent solutions. It should be given, as nearly as practicable, in the proportion of 25 parts to 1 of strychnin. Strychnin tannate is still soluble, though slowly, and should be evacuated at once. Animal charcoal, finely powdered, may also be given freely, to render the alkaloid less soluble. If the symptoms of poisoning have already developed when the patient is first seen, the introduction of the tube becomes impossible until complete anesthesia be induced by chloroform or ether. If the means of emptying the stomach are absent, emetics become necessary. A tablespoonful of mustard in hot water, or, better, 20 grains (1.3) of zinc sulphate or 10 grains (0.65) of copper sulphate in solution, should be given, or $\frac{1}{2}$ grain (0.032) of apomorphin hydrochlorate be injected under the skin. The promptest emetics must be chosen, as their early action is all-important. After each washing or act of vomiting, liquids containing tannic acid should be introduced into the stomach. As convulsions appear the patient should be brought fully under the influence of chloroform. This agent not only protects from the exhaustion of repeated convulsions, but is a physiologic antagonist of strychnin as well. Anesthesia may be continued for hours until the poison has been eliminated, and under it the stomach may be completely emptied of its contents if this have not been effected previously. Chloroform has been most successfully given by the stomach in strychnin-poisoning. Dresbach secured relief in twenty minutes from 2 fluidrams (8.) of chloroform when 3 grains (0.19) of strychnin had been taken.

In the intervals of the spasms large doses of chloral and of sodium or potassium bromid should be given. These drugs are also physiologic antidotes to strychnin. Murrell recommends $\frac{1}{2}$ ounce (16.) of the bromid with 30 grains (2.) of chloral, or 2 drams (8.) of the bromid with 10 grains (0.65) of chloral, every fifteen or twenty minutes. Chloral may also be given subcutaneously in doses of 10 grains (0.65), or by the rectum in doses of 1 dram (4.). Amyl nitrite may likewise be given by inhalation—5 minims (0.31) poured upon a handkerchief and held close to the nose. Murrell also recommends curare in doses of $\frac{1}{3}$ grain (0.022) by hypodermic injection. This remedy, however, cannot often be had upon demand.

A person poisoned with strychnin is readily thrown into convulsion by currents of air, noises, or movements of the body. He should therefore be kept absolutely at rest in a quiet room, with only the necessary attendants. During the convulsion great relief to suffering is afforded by firmly grasping

and holding the limbs and the body. In extreme cases artificial respiration may have great influence in prolonging life. Leube advises its continuance for three or four hours, but its value as ordinarily practised is doubtful.

### Gelsemium Sempervirens; Yellow Jasmin.

Recovery has followed a dose of 1 fluidram (4.) of the fluid extract, though the death of an adult has been reported from the same quantity. A boy three years old died after taking 12 minims (0.74) of the fluid extract. According to Wormley, a woman took 2-grain (0.12) doses of gelsemin every third hour until four doses had been taken, and died within an hour and a half after the last dose. The fatal result occurs in from one to seven hours.

There is no reliable chemic or physiologic antidote to yellow jasmin. If the patient is seen at once, the stomach-pump or the esophageal tube should be employed or a prompt emetic be given. The most effective emetics are copper sulphate and zinc sulphate, from 3 to 10 grains (0.19–0.65) of the former or from 5 to 20 grains (0.32–1.3) of the latter in solution. Mustard-flour, or even titillation of the fauces with a feather, will often serve in an emergency. The poison is absorbed and diffused with great rapidity, and, as its influence is profoundly depressing, active stimulation should be adopted at once. Whisky, brandy, ammonia, camphor, or musk should be administered by the mouth unless nausea be present, when it may be given subcutaneously or by the rectum. Courtright (H. C. Wood) claimed an antidotal action of morphin in gelsemium-poisoning, and reported successful results after giving from 1 to $1\frac{1}{2}$ grains (0.065–0.097) by the mouth or hypodermically. This agent certainly deserves a trial. Murrell recommends atropin, $\frac{1}{50}$ grain (0.0013) of the sulphate hypodermically, and again in fifteen minutes. In its stead tincture of belladonna may be used. The patient should maintain the supine position; but, indeed, there is no need for this precaution, as the patient must keep it perforce, being incapable of movement. In some cases and in cold weather artificial heat will be required, and in the most severe cases artificial respiration.

### Opium; Morphin.

The amount of opium or of its preparations or alkaloids necessary to fatal poisoning varies with the age, habits, and idiosyncrasies of the patients. Adults have been killed by $2\frac{1}{2}$ grains (0.16) of the extract of opium, by 1 fluidram (4.) of the tincture, by 3 grains (0.19) of the powder; 1 grain (0.065) of morphin acetate, hydrochlorate, or sulphate taken by the mouth has also caused death, and smaller doses hypodermically; 5 drops of the tincture, given by enema, have been known to kill a child eighteen months old. On the other hand, enormous doses, even in persons not habituated to the use of opium, have been recovered from—4 or 5 fluidounces (120.–150.) of the tincture, or from 10 to 20 grains (0.65–1.3) of a salt of morphin. The latter result, however, is likely to follow only when prompt vomiting has occurred or the drug has been taken upon a full stomach or upon one holding large quantities of tannic-acid-containing substances. It is quite impossible to fix

the limits of safety for habitués of opium or morphin, who are accustomed to take enormous quantities with impunity. When the termination is in death, it occurs in from six to twelve hours—often earlier, rarely later.

If the poisonous dose have been swallowed, free emesis should be excited at once. In opium-poisoning this is a matter of great difficulty, on account of the blunted reflex irritability of the nervous system. The fauces should be titillated with a feather or a finger, and a draught containing a tablespoonful of mustard-flour in a cupful of water should be administered and repeated every five minutes until effective; or a strong solution of table-salt in hot water may be given. Either of these should be administered as being the most available. If at hand, more efficient emetics are copper sulphate and zinc sulphate. Of the former, from 2 to 4 grains (0.13–0.26) dissolved in water should be given every five minutes until free emesis be induced; of the latter, 5 grains (0.32) dissolved in water may be given in a similar manner; or a single dose of 10 grains (0.65) of copper sulphate or of 20 grains (1.3) of zinc sulphate may prove more effective and thorough. If the patient refuse or be unable to swallow, $\frac{1}{6}$ grain (0.011) of apomorphin hydrochlorate should be injected under the skin. A much better method is to empty the stomach at once through the stomach-pump or through the esophageal tube used as a siphon. The stomach should be washed out repeatedly until all unabsorbed poison has been removed. Previous to the induction of vomiting and during its intervals copious drafts of strong coffee or tea or other liquid containing tannic acid should be administered, in order to render the alkaloids less soluble.

When the poison has been given hypodermically these measures are, of course, useless. Coffee, however, is also a physiologic antidote to opium, and while efforts to remove the unabsorbed remainder from the stomach are being made, strong black coffee should be prepared and given freely, not only by the stomach, but also by rectal injection in quantities of from $\frac{1}{2}$ to 1 pint (250.–500.). It is by no means certain that caffein will answer the same purpose, but under conditions forbidding the administration of coffee by the stomach or the rectum caffein may be injected subcutaneously. Tanret's formula for its solution is as follows: 31 parts of sodium salicylate, 40 parts of caffein, and 60 parts of water: 20 minims of this solution will contain about 13 grains (0.84) of caffein, which may be used for a single injection. But the most powerful antidote to opium-poisoning is atropin. It is a dangerous remedy, and should not be used with a free hand. The degree of opium-poisoning may be fairly measured by the contraction of the pupil, and to overcome this may require a quantity of atropin far beyond the limits of safety. Murrell considers $\frac{1}{300}$ grain (0.0022) of atropin antagonistic to 1 grain (0.065) of morphin. The real value of atropin consists in its property of stimulating the respiration and the heart. Wood recommends the subcutaneous injection of $\frac{1}{400}$ grain (0.0016) of atropin sulphate every fifteen, twenty, or thirty minutes. It would not be safe in the case of an adult to inject more than $\frac{1}{100}$ grain (0.0065) altogether. In children this agent must be employed with great caution. The dose for a child six years old would probably be from $\frac{1}{3000}$ (0.00022) to $\frac{1}{2000}$

(0.00032) of a grain. With infants it would probably be better to employ preparations of belladonna.

Recently potassium permanganate has been extolled as a specific antidote to opium-poisoning. Dr. Moor of New York claims, from observations made upon animals and upon himself, that the action of from 3 to 4 grains (0.19–0.26) of morphin sulphate may be overcome if twice the quantity of potassium permanganate be swallowed simultaneously or shortly afterward. Confirmatory evidence of this antidotal action of potassium permanganate is not wanting, and, contrary to what might have been expected, it is asserted that this drug is not merely a chemic antidote, but that a physiologic antagonism also is possessed by it. Thus it is claimed that its effects may be expected whether administered by the mouth or hypodermically, or in whatever manner the poison may have been taken. Carpenter[1] has recently reported an interesting observation of a case in which both drug and antidote were given hypodermically—10 minims (0.62) of a saturated solution repeated. Further experience is necessary, however, before we may definitely accept these claims as proved.

From the first every effort should be made to keep the patient awake or to arouse him if unconscious. He should be supported upon either side by an able-bodied attendant, and be marched up and down despite his piteous pleading to be let alone. To arouse the failing consciousness he should be buffeted, slapped, pinched, even switched with a cane or a whip. These attentions should not be remitted for an instant. If unconsciousness have already supervened, very rough handling should be resorted to ; vigorous slappings of the cheeks, chest, abdomen, nates, palms, and soles, flapping with wet towels, ammonia-vapor to the nostrils, the faradic battery, may all be employed. An excellent method of restoring consciousness is to tap briskly with the sharpened finger-nails upon the forehead. A most efficient means of stimulating respiration and arousing consciousness is to pour from a height alternating streams of cold and hot water. To do this the patient's head and shoulders should be drawn beyond the bed or lounge upon which he is resting, so that the clothing and covering may not become saturated. The stream of water may also be projected against the thorax. In cold weather especially neglect of ordinary precaution has been known to be followed by pneumonia or other dangerous disorder.

Should respiration appear to be upon the point of failing, amyl nitrite should be applied to the nostrils. At such times no measure is more important than artificial respiration. Practised intelligently and persistently, through it apparently hopeless cases may often be restored. This is especially the case with infants. Attention to the patient should not be relaxed until at least twelve hours after the dose has been taken. Fatal relapse has often succeeded apparently perfect restoration. In connection with other measures of artificial respiration, rhythmic traction of the tongue according to the method recommended by Laborde should be practised systematically. Stimulants should not be given until threatening symptoms have disappeared.

[1] *Medical News*, June 23, 1894.

# THE RESUSCITATION OF PERSONS APPARENTLY DROWNED.

By I. E. ATKINSON.

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The cause of death by drowning is asphyxia. A small number of deaths attributed to drowning are really cases of syncope in which failure of the heart has followed the exertion of swimming, surf-bathing, etc. in persons afflicted with valvular disease or with fatty or dilated hearts. This will probably prove to have been the cause of death in apparent cases of drowning when submersion may have been but momentary. Complete submersion for from one to two minutes in unpractised persons is usually sufficient to cause death. Experienced swimmers are able to remain under water for several minutes without inconvenience. Recovery is very improbable after submersion for five minutes, though it has been reported after fifteen or twenty minutes; in such cases submersion has probably been incomplete or has been preceded and accompanied by syncope. Submersion of the entire body is not essential to drowning: an unconscious person falling face downward into water only sufficiently deep to cover the mouth and nostrils will drown as certainly as if wholly immersed.

Whatever be the method of resuscitation adopted, it should be put into practice without a moment's delay. Time to convey the patient to shelter cannot be afforded unless the temperature of the atmosphere be so extremely low as to threaten, of itself, to destroy life after brief exposure. Under all other circumstances treatment must be begun at once and upon the spot. Bands, collars, belts, braces, corsets, and constraining clothing should be loosened or cut away. The mouth and the nostrils should be cleared of obstructions, liquid or solid. If signs of voluntary respiration persist, even though very feeble, they should be encouraged by brisk frictions of the chest, slapping, switching, by the application of ammonia-vapor to the nose, tickling the nostrils with a feather, and similar devices. The popular procedures of rolling the body on the ground or over a barrel, holding it with the head inverted and shaking it, with the idea of draining the water from the lungs, are very censurable and may readily snap the slender thread of life. The volume of water in the trachea and the bronchial tubes will always be small, and may be removed by simpler and less harmful measures. If the patient make no effort to breathe, without stopping to remove wet clothing or to secure a more suitable place for treatment, the body should be turned with the face downward and slightly lower than the level of the trunk, and the tongue be drawn forward. The operator should stand astride the hips, and, locking his

fingers together under the belly, raise the body as high as he can without lifting the forehead off the ground, give it a smart jerk, and hold it suspended long enough to count *one-two-three-four-five*, repeating the jerk more gently two or three times.[1] This procedure facilitates the escape of water and mucus from the mouth and throat. The patient should now be placed upon his side, and if breathing cannot be excited by the simple methods already mentioned, one of the following methods of inducing artificial respiration should be pursued.

The method of Marshall Hall, which was an important improvement upon the rough procedures supplanted by it, may be stated briefly: The patient is placed prone, with his forehead resting upon his bent arm, to secure the escape of fluids from the mouth and the nose. The tongue in this position will fall forward; if it does not, it should be drawn forward, so as not to obstruct the entrance of air into the windpipe. A folded coat or other article of clothing should be placed under the chest. Steady pressure should now be made upon the back, and be suddenly withdrawn as the body is gently rolled upon the side and a little beyond, when it should be briskly returned to the prone position. This operation should be repeated every four seconds, and be persevered in until respiratory efforts are made by the patient or it becomes evident that he is dead.

A better method than Hall's, because it acts more equally upon the two sides of the chest, is that of Sylvester, which is as follows: "Place the patient on the back upon a flat surface, inclined a little upward from the feet; raise and support the head and the shoulders on a firm cushion or folded article of dress placed under the shoulder-blades. Draw forward the tongue and keep it projecting beyond the lips. Standing at the head, grasp the arms just above the elbows and draw the arms gently and steadily upward above the head, and keep them stretched upward for two seconds. Then turn down the arms and press them firmly and gently for two seconds against the sides of the chest. Repeat these measures, alternately, deliberately, and perseveringly, about fifteen times in a minute."

The plan known as Howard's is very convenient and effective: The patient is turned upon his back, and a bolster of clothing or of other material is placed under him so as to throw his epigastrium forward. His wrists are crossed behind his head and held in that position. His tongue is drawn forward and held with a dry handkerchief in the extreme corner of his mouth. The operator now kneels astride the patient's hips, "resting the ball of each thumb upon the corresponding costo-xiphoid ligaments, the fingers falling naturally into the lower intercostal spaces. Resting his elbows against his sides and using his knees as a pivot, he throws his whole weight slowly and steadily forward until his mouth nearly touches the mouth of the patient, and while he might slowly count *one-two-three;* then *suddenly*, by a final push, springs himself back into his first erect position on his knees; he remains there while he might slowly count *one-two*, then repeats, and so on about eight or ten times in a minute."

[1] Michigan method.

The "Michigan method," however, probably offers advantages over any other. The patient is placed upon the ground, face downward; the operator stands astride the hips and grasps the points of the shoulders by the clothing, or, if the body be naked, thrusts his fingers into the armpits, clasping the thumbs over the points of the shoulders, and *raises the chest as high as he can* without lifting the head quite off the ground, and holds it thus long enough to count *one-two-three.* He then replaces the body upon the ground, with the forehead resting upon the flexed arm, the neck straightened, and the mouth and the nose free. Then, placing his elbows against his knees and his hands upon the sides of the patient's chest over the lower ribs, he presses downward and inward with increasing force long enough to count *one-two* slowly. He then lets go suddenly, grasps the shoulders as before, raises the chest, and repeats the procedure. These movements should be repeated ten or fifteen times in a minute.

Hope of resuscitation should not be abandoned until artificial respiration has been persisted in for at least two hours. Free access of air to the lungs will be facilitated by extending the head and simultaneously projecting it forward. This may be done by catching the jaw close to the condyles and pressing it as strongly forward as possible. In this way the tongue is most effectually kept from closing the glottis.

Laborde has recently asserted that respiration may be re-established more certainly by exerting successive and rhythmic traction upon the tongue than by any other method. The tongue may be grasped with the fingers or with a tenaculum and be drawn forward with every inspiration, or, if respiration be totally in abeyance, once every four seconds. He holds that traction upon the tongue exerts an excitation of the afferent nerves, and, acting reflexly upon the motor respiratory nerves, particularly upon the phrenic, re-awakens the movements of the diaphragm, and thus the respiratory function.

As soon as artificial respiration has been put into practice, accessory measures of relief should be adopted. Abundant fresh air should be secured; the wet clothing should be cut away to the waist; the skin should be rubbed dry and be protected by warm, dry covering; hot-water bottles or hot bricks should be applied to the thighs, sides, arms, etc., care being exercised not to burn the flesh of the unconscious patient. No attempts to administer stimulants should be made until it is certain that the patient can swallow. Until respiration has become re-established, rectal or hypodermic injections of stimulants should be avoided, as it is undesirable to excite the heart to more vigorous action in the absence of the respiratory function. As soon as voluntary respiration is established, the patient may be put to bed and the necessary stimulating and supporting treatment be adopted. Perseverance in attempts at resuscitation cannot be insisted upon too strongly. Success occasionally crowns the effort under the most desperate conditions. If, at the end of two hours, "the eyes remain open, the pupils dilated, the conjunctivæ insensitive, the countenance placid, the skin cold, the nostrils and mouth covered with frothy mucus, with no attempt at respiration and no sign of heart-action," hope may be abandoned.

# FOOD-INFECTION.

By VICTOR C. VAUGHAN.

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Reported instances of serious illness resulting from infected food are becoming quite common. The increase in the number of cases of this kind is partly real and partly only apparent. One cause of the actual increase in frequency is due to the larger consumption of preserved foods. Meats, the appearance and odor of which would render their sale in the piece impossible, may be chopped, cooked, canned, and sold as prime goods. It is not intended to imply that this fraud is commonly practised; but that it is a possible one cannot be denied, and that it has occasionally been resorted to has been demonstrated. This source of danger to health will remain until the scientific inspection of food is understood and practised. By far the greater number of cases of poisoning by prepared foods, however, arises from imperfections in methods or from lack of intelligent and conscientious attention to details. When we recognize the fact that the successful preparation of every portion of preserved food depends upon the exclusion of micro-organisms, both specific and putrefactive, and when we learn that the processes are carried out for the most part by those who are ignorant of the scientific principles involved, then we can only wonder that the health of the consumer is not more frequently endangered.

The apparent increase in the number of cases of poisoning by food is due to the fact that it is only within recent years that the medical profession has learned to recognize food-infection as a frequent cause of illness, or, at least, has been in possession of the knowledge necessary to convert suspicion into positive demonstration. We are now able to show, for instance, that cholera infantum is not due to mysterious and unknowable telluric or meteorologic conditions, but that every case of this disease results from infected, and consequently poisonous, food. We also know that many cases that were formerly attributed to accidental poisoning with some metallic gastro-intestinal irritant are also due to infected food, and that the same agency may induce diseases simulating typhoid fever, pneumonia, and certain exanthemata.

The expression "ptomain-poisoning" has been used quite largely in recent years to designate cases of illness that arise from infected food. While basic products of bacterial origin are in some instances the actual *materies morbi*, this is not always the case. Among the bacterial products with toxic properties there are to be found many that are not basic and that have been designated as toxalbumins. A more exact study of these substances, some of

which are most potent poisons, will be necessary before they can be classified chemically with any scientific precision. Moreover, in many instances we remain as yet in complete ignorance not only of the nature of the chemic bodies that cause the untoward symptoms, but of the nature of the bacteria through the activity of which these poisons are generated. Therefore it seems wise to confine ourselves at present to the term "food-infection." This is preferred to "food-poisoning," because, while in some instances the active chemic agent is formed in the food before it is taken, in others it originates from the continued activity of the bacteria after introduction into the body. Some are cases of intoxication, while others are more truly instances of infection; but in all cases infection of the food, before or after its introduction into the body, occurs. This infection of the food is the essential element at all times. It is this that must be prevented, and to this especial attention should be called.

The sources of the dangerous infection of food may be discussed under the following heads: (1) The infection may be due to a diseased condition of the animal from which the flesh or milk was obtained; (2) the infection may be due to the inoculation of the food with specific micro-organisms outside the body of the animal from which it was derived; (3) food is often infected with saprophytic, toxicogenic bacteria.

(1) The transmission of disease from a lower animal to man through the employment of the flesh or milk of the former as a food by the latter has repeatedly been shown to occur. The cases so admirably studied by Gärtner of Jena illustrate the truth of this statement. A cow while suffering from mucous diarrhea was killed. Post-mortem examination revealed certain highly inflamed areas in the intestine. There was no enlargement of the liver or spleen, and the flesh, being normal in color and odor, was pronounced by the veterinarian as suitable for food. Fifty-seven persons in twenty-five families were made ill by eating of this flesh, twelve having eaten the raw meat, one some that was partially cooked, and the remainder some that was supposed to have been cooked thoroughly. A vigorous young man ate 800 grams of the raw meat at 8 P. M.; two hours later he began to vomit and purge, and thirty-five hours after eating the meat he died. Post-mortem examination revealed an inflammatory condition of the small intestine and swelling of Peyer's patches. All those who ate of the raw meat were sick; while of those who ate only that which had been cooked, thirty-six were not affected. Among those who ate of the raw meat, the severity of the illness was in direct proportion to the amount eaten. Thus, while 800 grams caused death within thirty-five hours, as has been stated, one-sixth of that quantity produced an illness of fourteen days terminating in recovery. In many there was marked elevation of temperature, running as high as 104° F. In the severe cases, in some of which the patients were ill for four weeks, there was desquamation of the epidermis of the entire body. In the meat and in the tissues of the dead man Gärtner found a short bacillus which he has designated as *bacillus enteritidis*. Susceptible animals inoculated with pure cultures of this germ died. The chemic poison was not isolated, but its existence was demon-

strated by the fact that sterilized cultures injected into animals caused sickness and death. There can be no doubt that in these cases the flesh of the infected animal caused the peculiar and characteristic illness of those who ate of it. Good beef inoculated with this bacillus, and cooked some hours later, killed rabbits, guinea-pigs, and mice.

In 1887, 292 persons at Middleburg, Holland, were taken sick after eating the flesh from a cow that had died with puerperal fever. The symptoms were nausea, vomiting, purging, elevation of temperature, and prostration. In some, dizziness, somnolence, and dilatation of the pupils occurred. In many an eczematous eruption upon the lips gave annoyance. Thorough cooking did not destroy the poison, and those who took soup and bouillon made from the meat were affected in the same way as those who ate of the fiber. In most of these cases the symptoms appeared within twelve hours after eating the meat. Pigs, cats, and dogs that ate of the offal of the infected cow were also made sick.

The outbreak of meat-poisoning investigated by Gaffky and Paak most probably belongs to this class, though it was not positively shown that the horse from which the meat was obtained was sick, and it is possible that the infection may have occurred in the shop of the butcher. In the majority of the persons who ate of this meat the symptoms manifested themselves within six hours, and in one instance within half an hour.

The transmission of tuberculosis, anthrax, glanders, and pleuro-pneumonia from animals to man by the eating of infected meat comes, strictly speaking, within the limits of the subject now under discussion; but, as the therapeutics of these diseases is not influenced by the manner in which they originate, it would be out of place to elaborate this point in this place.

(2) The infection of meat and milk outside the body with specific pathogenic bacteria is so well known that it needs no more than mention here. The frequency with which typhoid fever, diphtheria, and other infectious diseases are disseminated by the use of milk infected in this manner is shown in the current records of medical literature. Milk has been diluted with infected water, and the prevalence of the disease has marked the daily rounds of the milkman.

(3) In the great majority of instances the harmful infection of meat and milk is due to the presence of saprophytic, toxicogenic germs. It is a fact that meat and milk, even when derived from perfectly healthy animals and when kept free from infection with specific pathogenic bacteria, may, and often do, develop most potent poisonous properties. It is not necessary that food be infected with some specific micro-organism in order for it to be rendered unfit for use.

It may be well to discuss briefly the nature of some of the germs with which food may become dangerously infected outside the animal body, and also the nature of the poisons that are produced by these germs. Unfortunately, this class of micro-organisms has not been studied with the thoroughness and detail that it deserves. From the studies that have been made, however, we may draw the following conclusions:

(*a*) Many of the bacteria with which meat and milk become infected belong to the saprophytic organisms. The harmful germs have not been derived either directly or indirectly from a diseased animal.* I can illustrate this by reference to cases of poisoning from frozen custard that I had an opportunity of investigating a few years ago. The milk supplied to a certain small village in Michigan had never been questioned. It was in constant use by some fifty people or more, and no case of illness had arisen that could in any manner be attributed to the milk. In the preparation for a festival some gallons of this milk were obtained and made into a custard. This was divided into two portions, one of which was flavored with lemon and the other with vanilla. The lemon-custard was eaten without harmful effect, while a teaspoonful of that flavored with vanilla caused nausea, vomiting, and purging. It was quite natural to conclude that the vanilla was the poisonous agent, because at first it seemed that the only difference between the two portions was in the flavoring. Fortunately, however, not more than half the vanilla in the bottle had been used, and the non-poisonous character of this flavoring was demonstrated by a young man who took two teaspoonfuls of the remainder without being in any way affected. The real difference between the two portions of the custard is explained as follows: The lemon-custard was frozen immediately and was sent to the festival, while the vanilla-custard, before being frozen, stood for two hours on a hot day in a very filthy room, the air of which is said to have been like that of a privy-vault. This room had some weeks before been used as a butcher-shop and had not been cleaned, and the bits of decomposing meat rendered the air foul and supplied the germs with which the custard was infected.

In another instance some dozens of dressed chickens were bought, cooked, and made into a salad. Several persons ate of the freshly made salad without ill effect. The salad was then placed in a close, foul room, where it stood for three days. It was then served at a banquet. Of two hundred persons that ate of this salad at the banquet, not one escaped more or less serious illness. All suffered from nausea, vomiting, and purging. Mr. Perkins, my laboratory-assistant, found in this salad a short, non-motile bacillus, growing in anaërobic cultures, which proved fatal to guinea-pigs, but which was without effect upon white rats.

A similar case has been reported by Barnes of Carlisle, England. A wedding-party partook of a cold breakfast that had been standing over night in a poorly ventilated cellar in which milk and meat were prone to go bad. Only four of those at the breakfast escaped illness, and one died. A bacterial poison was found in some ham, one of the dishes partaken of.

In these illustrative cases the facts that the germs did not originate in any specific disease and that they grew in the food before it was taken into the body of the consumer demonstrate the correctness of the foregoing proposition. But it may be asked, How is it possible for a truly saprophytic germ to induce disease and death? This may occur in either of two ways: the poison formed in the food before it is eaten may be the sole and sufficient

cause of death, or the formation of the poison may continue in the body. In the first case the germ may be one that could not possibly continue to live after its introduction into the body. This is illustrated by the Iron Bridge cases reported by Ballard. Twelve out of fifteen persons in a family partook of "warmed-over" veal-pie. All who partook sickened. The pie contained a bacillus, cultures of which had "a most exquisite and delicate aromatic odor" and induced death when fed to mice, while inoculations with the bacillus were without effect. In fact, this organism was found not to grow at 36° C. (96.8° F.), but when grown at lower temperatures it produced a chemic poison. This is interesting, and shows that we cannot hope to recover the offending germ from the body in all cases of food-infection. In other cases it may happen that the acid of the gastric juice destroys the organism, but is without effect on its chemic products.

(*b*) A germ may grow in the intestines and still be an obligate saprophyte. The food in the duodenum has no more vitality than that in the dish. Moreover, the secretions poured out into the intestines are not supposed to be possessed of vitality. A germ that will grow in a culture-flask and produce a poison may grow on the same medium in the intestines and produce the same poison, provided it is not destroyed or modified by some secretion or condition (such as temperature) of the body.

(*c*) Some of the saprophytic bacteria with which food is infected outside the body may be, and probably are, under certain conditions, capable of living, for a time at least, in a parasitic manner. Thus, Novy has found the same germ in poisonous cheese and in the spleens and livers of animals that had been killed by being fed on cultures made from the cheese. The parasitic nature of this germ —or, in other words, its capability of overcoming the resistance of the living tissues—seems, however, to have been feeble, and, instead of increasing in virulence as it was passed through successive animals, it became markedly less pathogenic and finally was wholly without effect. From this and similar experiences with saprophytic germs obtained from poisonous food and drinking-water, I infer that the toxicogenic properties of these organisms are best manifested when they are grown on dead matter.

(*d*) The toxicogenic properties of these bacteria are also influenced largely by the conditions under which they develop. The most important of these conditions are the nature of the infected food, the temperature, the amount of oxygen supplied, and the time that elapses between the infection and the consumption of the food. Certain germs that grow most abundantly in milk fail to live in meat-preparations. Indeed, the researches of Escherich have shown that the bacterial flora of the intestine of the milk-fed infant is constant and characteristic, and that it changes radically when milk is withheld and meat-preparations are substituted. That temperature influences the growth needs only to be mentioned in this connection, for it is a fact now generally recognized that the toxicogenic germs found in milk, and which cause the summer diarrheas of infants, do not multiply below 60° F. (15.6° C.). I am convinced that the poisonous properties of canned meats are in some instances

due to the fact that the germs which they contain grow practically without air. The following brief report of a case of poisoning with canned salmon supports this belief: In May, 1891, K., a very vigorous man of thirty-four years, ate freely of canned salmon. Others at the table remarked that the taste of the salmon was peculiar, and refrained from eating it. Twelve hours later K. began to suffer from nausea, vomiting, and griping pain in the abdomen. Eighteen hours after he had eaten the salmon, I first saw him. The man was vomiting small quantities of mucus, colored with bile, at frequent intervals. There had been no evacuation of the bowels, and the griping pain continued to be very severe. He was covered with a scarlatinous rash from head to foot. His pulse was 140, his temperature 102° F. (38.9° C.), and his respiration was shallow and irregular. The stomach and large intestines were thoroughly washed out, and 10 grains (0.65) of calomel, soon followed by 12 ounces (360.) of the solution of magnesium citrate, for the purpose of cleansing the small intestines, were administered. After these medicines had acted freely K. began to improve. The next day the rash had disappeared, but the temperature remained above the normal for four or five days, and it was not until a week later that the gentleman was able to leave his house, so great was the exhaustion. The remainder of the salmon was submitted to various tests. In the first place, the absence of inorganic poisons was demonstrated. Secondly, it was found that the subcutaneous injection of 20 drops of the fluid expressed from the salmon caused evident illness and suffering in a white rat. The only germ that could be found, either by direct microscopic examination or by the preparation of plate-cultures, was a micrococcus, and this was present in great numbers. This germ grows fairly well in beef-tea, but intra-abdominal injections of 5 cubic centimeters of these cultures fail to affect white rats, kittens, or rabbits. This micrococcus, however, when grown for twenty days in a sterilized egg, after Hueppe's method of anaërobic culture, produces a most potent proteid poison. The white of the egg becomes watery and markedly alkaline, and 10 drops suffice to kill white rats. Evidently, in the preparation of the salmon the contents of this can were not sterilized; the can was sealed, and for months, possibly longer, this germ had been growing anaërobically and elaborating a chemic poison. On the other hand, I am cognizant of several instances in which canned meats were not poisonous when first opened, but soon became so on exposure to the air. In these cases the meat became infected after the opening of the can.

Some general remarks concerning the chemic poisons formed in infected food may be of interest. First, the ptomains that are formed in foods as a result of the activity of saprophytic bacteria may very properly be called "putrefactive alkaloids." Secondly, there are the poisonous bacterial proteids, the so-called "toxalbumins." My studies have caused me to conclude that of these two classes the proteids are more frequently present in infected foods. That some of these proteids are absorbed from the alimentary canal has been demonstrated, but their potency is much less when taken in this way than when given hypodermically. If this were not true, fatal cases of

food-poisoning would be much more common. As it has been found that some of the bacterial proteids are destroyed by a temperature approaching that of boiling water, it is assumed by some that this is universally true, and that cooked meat or boiled milk cannot be poisonous. This is an assumption that we are at present hardly justified in making. Certainly, some of the bacterial proteids can be kept for ten or fifteen minutes at 100° C. (212° F.), and for a much longer period at 80° C. (176° F.), without being destroyed. I have dried some of these bodies to a constant weight at 100° C. (212° F.) without any appreciable decrease in toxicity. However, in solution a much lower temperature prolonged for some time rendered them inert.

I have examined poisonous foods in which I have wholly failed to determine the nature of the active constituent. Some years ago, several persons were seriously affected by eating mince-pies. The prepared meat, a large portion of which was brought to me, invariably caused vomiting and purging in cats and dogs fed upon it. It may be stated that the animals partook freely of it when offered them, after the alcohol used in its preparation had been evaporated at a low temperature, and were affected alike by the cooked and the uncooked meat. Of course the persons affected had eaten of the cooked meat in the pies. Notwithstanding this positive evidence of the poisonous character of the food, the nature of the active agents was not ascertained. The most thorough and exact tests known were made for inorganic poisons, for active ptomains, and for bacterial proteids, but with absolutely negative results. Furthermore, plate-cultures were made, and the isolated germs, in both pure and mixed cultures, were fed to and injected into animals without effect. It is probable that the poisonous constituent was destroyed by the manipulations resorted to in the attempts to isolate it.

### Infected Milk and Milk-products.

The infection of milk is one of the most serious questions that can interest the medical profession, as it constitutes one of the most important factors in the causation of infantile mortality, which must be admitted to be great. More than one-fourth of the children born to the civilized world die before they reach five years of age. A large number of these deaths are due either directly or indirectly to the so-called "summer diarrheas." These diarrheas are confined almost exclusively to children fed artificially in whole or in part, and they are not due to one specific germ, but may be caused by any one of a large number of micro-organisms, as has been shown by the researches of Booker and Jeffries in this country and of Escherich and Baginsky in Germany. These germs are saprophytic, and their harmful effects are due to the chemic poisons that they elaborate. Baginsky and Stadthagen have obtained from cultures of a saprophytic germ from the stools of a child with diarrhea a poisonous base and a poisonous proteid, and I have isolated from pure cultures of three of Booker's germs a proteid that caused in kittens vomiting, purging, and death. I have also found tyrotoxicon in some milk, a portion of which had been fed to a healthy child, the feeding having been

followed in less than two hours by the first symptoms of a typical and severe case of cholera infantum. For a more extended discussion of this subject the reader is referred to the article on Diarrhea in the *American Text-Book of Diseases of Children.*[1]

We now know of the existence of a poisonous base (tyrotoxicon) and of poisonous proteids in certain samples of cheese. If, however, we expect to find that all pieces of poisonous cheese contain the same toxic agent, we shall be disappointed. Indeed, with our present knowledge of the manner in which these poisons are formed, it would be very unscientific to expect to find one substance responsible for the effects that follow the eating of different samples of poisonous cheese. It must be remembered that these poisons are due to a variety of species of germs, and that the chemic nature of the product is likely to vary not only with the kind of germ but also with the stage of fermentation. Indeed, it is possible for different portions of the same cheese to contain colonies of wholly distinct germs, and consequently to yield different poisons. It certainly is a fact that one portion of a cheese may be poisonous and other portions not. I have examined samples of cheese the surface parts of which could be eaten without ill effect, while the inner portions were highly poisonous to both man and the lower animals; Ehrhart has reported a similar experience.

The method of making cheese generally practised is especially favorable for the collection of a large number and variety of germs. The milk is brought to the factory by the farmers of the vicinity. There is no intelligent inspection of the cows, their food, drinking-water supply, or stabling. Some of the cans are properly scalded and dried, while there is always the probability that others are not. The milking may be done in filthy stalls, with dirty hands, from unclean udders, and possibly into pails that have not received proper care. Then it is to be feared that the milkman's standard of honesty is not always high enough to restrain him from diluting the lacteal fluid, and sterilized water is not usually employed for this purpose. Moreover, the cheese-maker himself is not always duly appreciative of the necessity of cleanliness about the factory and in the manipulations to which the milk is subjected.

Ice-creams, frozen custard, cream-puffs, and other articles of diet composed in part of milk are known at times to contain the poisons already referred to.

The symptoms induced by tyrotoxicon may be briefly stated as follows: Usually the first evidence of the effects of the poison consists in a very distressing constriction of the fauces. This cannot be said to be painful, but it causes alarm. The affected person takes a long breath, assuring himself that he can get enough air. He has no difficulty in doing this, but in a moment he feels that he must try again, and he is sure that he will now fail. Then sudden and overwhelming nausea manifests itself, and, fortunately, vomiting generally follows promptly. If the latter be delayed the retching is very distressing, and during the short intermissions in the straining the sufferer pants for breath and becomes very apprehensive. The vomiting brings some relief.

[1] Published by W. B. Saunders, Philadelphia, Pa.

First come the food-contents of the stomach, and then mucus colored with bile and in some cases with blood. A twisting, griping pain seems to begin in the duodenum and to pass along the entire course of the intestine, both small and large. If the bowels move, relief follows for a few moments. Chilly sensations creep along the back, and nervous twitching of the extremities is apparent. Dizziness and syncope may give cause for alarm. These are the symptoms ordinarily observed, and they gradually subside after the expulsion of the poison, leaving the person more or less exhausted. In this form of tyrotoxicon-poisoning the danger to life is not great. However, deaths may and do occur. The vomiting and purging are not to be checked unless there is marked danger of failure of the heart. When this is feared opiates and stimulants are of service. Of the different preparations of opium, I prefer in these cases the camphorated tincture, and give it in full doses. The aromatic spirit of ammonia and alcoholic stimulants may be given with advantage. Unless the vomiting and purging threaten exhaustion, they should not be checked. Indeed, it is best to take the cue from nature's attempts, and wash out the stomach and intestines. This procedure will exhaust the strength less and will be much more efficient than other measures. The attending physician is dealing with a poison for which he has neither chemic nor physiologic antidote, and it fails to kill only because it is expelled by the vomiting and purging. The only treatment possible, therefore, is to assist in removing the offending substance and to see that the reflexes by which the expulsion is effected are not allowed, by either the excess or the inefficiency of their action, to do irreparable harm.

In the severer forms of tyrotoxicon-poisoning both vomiting and movement of the bowels may be quite impossible. Vomiting is, however, much less frequently absent than purging. Usually in the more dangerous cases nausea and vomiting are among the first symptoms, while the bowels are obstinately closed, and as the effects of the poison deepen the vomiting ceases. These are the cases that are most likely to terminate fatally. The temperature, which in the less severe forms may be more or less elevated, falls and coma sets in. The following is a short quotation from my report on the Milan cases of fatal tyrotoxicon-poisoning:

"On a sofa in the first room we found the daughter Alma. She had been vomiting during the day, and seemed much exhausted. She was not inclined to talk, and seemed to be in a stupor, though when spoken to she responded rationally. Her pupils were slightly dilated, her tongue coated, her pulse 120 and weak, her face flushed, and a violent throbbing could be felt over the abdomen, which was retracted. Her temperature was 96°.

"In another room were father, mother, and son, the last two dying. The father was rational, and talked with some ease when asked as to the kind of food they had been eating, etc. His pupils were normal. His pulse was rapid, breathing somewhat labored, and the throbbing of the abdominal aorta was plainly felt. The abdomen was retracted, and there was no pain on pressure. He complained of a burning constriction of the throat, swal-

lowed with difficulty, and said that his throat and stomach felt as though they were on fire.

"The mother lay perfectly still, with eyelids closed, as if in a deep sleep. Her pulse was rapid, her face had a livid flush, her breathing was 35 per minute and labored; temperature 94°. The skin was cool, but neither abnormally moist nor specially harsh and dry. She could not be aroused. In fact, she was comatose, and died within twenty-four hours.

"The son rolled uneasily from one side of the bed to the other. His breathing was very labored. Temperature 95°. His eyelids were closed, and the pupils were markedly dilated—did not respond to light. He could not be aroused. In mother and son, as well as in father and daughter, the abdomen was retracted and the throbbing of the abdominal aorta could easily be felt."

Atropin has been suggested as a possibly beneficial agent in relieving the intestinal constriction to which the constipation in these cases is due, but there is no record of it having been tried. The constriction may be so tight in cases thoroughly under the influence of the poison that irrigation of the intestine is a physical impossibility. Mesic found in the Milan cases that amyl nitrite relieved the dizziness and confused sensation in the head in the only member of the family who recovered.

### Poisonous Mussels.

From the symptoms it may be supposed that there are three kinds of poisonous mussels. Brieger has isolated and studied mytilotoxin, the active agent in some poisonous mussels found at Wilhelmshaven. This substance has a curare-like action, and the following effects in man have been noted: Constriction of the throat, mouth, and lips; the teeth are set on edge, as though sour apples had been eaten; there is dizziness, but no headache, a sensation of flying, and an intoxication resembling that produced by alcohol; the pulse is rapid and hard, without elevation of temperature; the pupils are dilated and reactionless; speech is difficult, broken, and jerky; the limbs feel heavy, and power of co-ordination is lost, as is shown by the spasmodic grasping at objects (which are missed) and by the staggering gait; the hands become numb and the feet cold: this sensation may extend over the whole body, and sometimes the perspiration flows freely. Some complain of a sense of suffocation, followed by restful and dreamless sleep. In the cases observed by Schmidtmann one person died in less than two hours, another in less than four hours, and a third within five hours after eating of the mussels.

In a second class there is a sensation of heat and itching, usually appearing in the eyelids, extending to the face, and sometimes involving the entire body. An eruption, usually called a "nettle-rash," though it may be pustular or vesicular, covers the parts. The itching becomes most distressing, and may be accompanied by marked swelling. There is labored, asthmatic breathing, which is relieved by ether. Mohring reports cases in which dyspnea preceded the eruption and insensibility followed, the face became livid, and convulsive

movements of the extremities were noticed. Burrow reports similar cases, with delirium, convulsions, coma, and death within three days.

In the third class the symptoms are choleraic. Fodere reports a case in which nausea, vomiting, pain in the stomach, tenesmus, and rapid pulse were noted, and after death, which occurred within two days, the stomach and intestines were found inflamed and filled with tenacious mucus. As long ago as 1827, Combe gave a very graphic description of the choleraic form of mussel-poisoning. Christison examined the food and vomited matter in the cases observed by Combe, and demonstrated the absence of copper and other metallic poisons.

The treatment must be largely symptomatic. However, it is true here, as it is in cheese-poisoning and milk-poisoning, that, having neither chemic nor physiologic antidote, we must rely on elimination, and when the excited reflexes are not doing this satisfactorily, aid must be given them. Indeed, this must be the controlling principle in the treatment of all forms of poisoning due to food-infection.

### Meat-poisoning and Sausage-poisoning.

Sausage-poisoning, known as "botulismus" and "allantiasis," has long been a frequent occurrence, especially in Wurtemberg and Baden. This has been due undoubtedly to the methods there practised of preparing and curing this article of food. Blood that has been kept, sometimes for days, in wooden boxes is said to be used. Stomachs of hogs are filled with this blood and with ground meat, and are cured by hanging in the kitchen chimney of the peasant. At night the fire often goes out and the meat freezes, the alternate freezing and thawing rendering decomposition more easy. The inner portions of these huge sausages are likely to be poisonous. I believe that this method of preparing sausage in the parts of Germany named is not so commonly practised now as it was twenty years ago or more, and cases of sausage-poisoning occur less frequently.

Of the 124 cases reported by Müller, the majority sickened within twenty-four hours, and out of the 48 terminating fatally, 6 died on the first day. There is dryness of the mouth, constriction of the throat, pain in the stomach, nausea, vomiting, vertigo, indistinctness of vision, dilatation of the pupils, difficulty in swallowing, and usually purging, though in the more serious cases obstinate constipation may exist from the first. As a rule, there is a sensation of suffocation and the breathing becomes labored. The pulse is usually small, thready, and rapid, and at times imperceptible at the wrist. Nervous prostration and great muscular weakness may follow. The symptoms vary greatly in individual cases. As a rule, the mind remains clear, but there may be delirium and coma. Convulsive movements may be marked or paralysis may appear early. Dilatation of the pupils is frequent, but not constant. Complete blindness has resulted in a few instances.

The mortality varies greatly—from less than 2 per cent. in one outbreak to more than 54 per cent. in the 155 cases cited by Kerner.

Ballard has studied quite thoroughly fourteen outbreaks of meat-poisoning in England, in which in the aggregate many thousand persons were affected and several hundred deaths resulted. In thirteen of the outbreaks the diseases induced were, if not identical, so nearly so that it was not possible to distinguish among them. The symptoms were those of gastro-intestinal irritation, with more or less marked secondary effects upon the nervous system. In the fourteenth epidemic, in which 490 deaths resulted, the symptoms were those of pleuro-pneumonia. Bacon prepared by one firm was found to be the source of this trouble. Mice fed upon this meat developed a disease similar to that observed in the people, and the same bacillus was found in the bacon, in the lungs of the mice killed by eating it, and in the sputum and lungs of the patients. This is the only instance in which pneumonia has been traced to infected meat. Bottard believes that this meat did not come from infected animals, but that it became infected in the factory in which it was prepared and from which it was sold to the consumer.

### Fish-poisoning (Ichthyismus).

Some fish possess poison-glands by the aid of which they protect themselves. Bottard describes five different forms of poison-glands in fish: (1) As in *Synancea brachio*, there are closed poison-glands in the dorsal fin. There are thirteen barbs, and two poison-reservoirs for each. Each reservoir is supplied by two tubular glands, the secretion of which is a bluish, feebly acid fluid, which, undiluted, induces local gangrene; when diluted, local paralysis. In *Plotosus lineatus* a hollow barb in front of the ventral fin conducts the poison from a gland situated at its base. (2) In *Trachinus draco* three double-bored barbs are placed on the gill-covering and are connected with glands that secrete only during the spawning season. (3) In *Thalassophryne reticulata* there is a half-closed poison-gland situated on the gill-covering, and another on the back. (4) In *Murœna helena* there is on the roof of the mouth a wide pocket the walls of which are lined with poison-glands. This pocket furnishes a secretion that covers some of the teeth. (5) In *Scorpœna scropha* there are open poison-glands connected with the hollow barbs of the dorsal and caudal fins.

Miura and Takesaki found that the ripe ovaries of *Tetrodon rubripes* contain a substance that induces in rabbits acceleration of the respiratory movements, paralysis of the skeletal muscles, mydriasis, increased peristalsis of the intestines, and failure of the heart.

The disease known as "kakke," which prevails from May to October in Tokio, is, according to Miura, an intoxication due to the eating of fish that belong to the *Scombridæ*. The affection is generally chronic or subacute, seldom acute. The most characteristic symptom is paralysis of the diaphragm, with consequent dyspnea and disturbance of the action of the heart. Electric stimulation of the diaphragm has proved to be the most successful treatment.

According to Remy, there are in Japan twelve species of fish with poisonous ovaries. In winter, on account of the physiologic atrophy of these organs,

less harm comes from eating the fish. Dogs fed upon the fresh ovaries or testicles vomit frequently and manifest convulsive muscular contractions and marked salivation. Remy rubbed up the organs in a mortar and injected some of the fluid hypodermically into dogs. Although this was done in winter, death resulted in less than two hours. The symptoms were vomiting of abundant quantities of mucus, dilatation of the pupils, marked dyspnea, and paralysis. Examination showed ecchymoses in the pancreas and salivary glands, hemorrhagic spots in the intestines and stomach, and the liver and kidneys filled with dark blood.

In the West Indies certain species of fish, as *Clupea venenosa*, are, according to Günther, always poisonous. They have no poison-glands, nor are their ovaries poisonous. They are believed to acquire their poisonous properties from certain Medusæ and corals upon which they feed. When eaten, a gastro-enteritis, which may terminate fatally, follows.

In Russia, intoxication often results from the eating of both fresh and preserved sturgeon and salmon. This effect is believed to be due to an infectious disease prevalent among the fish. The poison is a cerebro-spinal one, inducing convulsions and paralysis. *Ichthyismus gastricus*, observed in some parts of Germany, is believed to be due to the eating of sick barbels. This affection is in some places called "Barbencholera." The treatment consists in the administration of cracked ice and opium and the application of hot poultices. *Ichthyismus exanthematicus*, in which the gastro-intestinal irritation is accompanied by a scarlatinous rash, is believed by Kobert to be due to the eating of infected mackerel, gar-eels, oysters, and mussels.

*Petromyzon fluviatilis*, which is not classed by modern zoologists among fish, induces an intoxication frequently observed among the inhabitants in the Jamburg district of Russia. The animal is poisonous in both the raw and the cooked state, and induces a hemorrhagic dysentery. If the animal while yet alive be sprinkled with salt, it excretes a large quantity of a thick mucus and is thereby freed from poison (Kobert).

The uncooked blood of certain eels is poisonous. Kobert mentions a case in which a man took the fresh blood from 0.64 kilogram (1½ lbs.) of eel, stirred it with 200 cubic centimeters (6¾ ounces) of wine, and drank the whole. The most violent purging, with stertorous breathing, foaming at the mouth, leaden color of the face, and glazed appearance of the eyes, resulted. Opium was administered, and recovery followed. The blood-serum of the river-eel induces, according to Springfield, first nervous excitement, then convulsions followed by paralysis.

The most frequent cases of fish-poisoning, however, are those due to the infection of this food with toxicogenic, saprophytic germs. This infection frequently occurs with canned and otherwise preserved fish. The symptoms induced vary greatly according to the nature of the infecting germs and the stage of fermentation. Ptomatropin is a frequent constituent of putrid fish. This substance has never been obtained in pure form, but it is removed from alkaline solution by shaking with ether. It is a ptomaïn, and occurs not only

in fish, but also in other infected meats. The symptoms to which it gives rise are almost identical with those of atropin, such as dryness of the throat, complete arrest of the secretion of saliva, the widest dilatation of the pupils, ptosis, paralysis of accommodation, weak and rapid pulse, nervous excitement, possibly convulsions, and with large doses a low, wandering delirium passing into coma and terminating in death. Section shows venous congestion of the brain, lungs, and kidneys, often with hemorrhagic spots in the stomach and intestines and cloudy swelling of the solitary follicles and of Peyer's patches.

Ptomatropin gives the general alkaloidal reactions, and at present there is no way of distinguishing it from atropin; in fact, it may be in truth a putrefactive form of atropin, so far as we know. It is recognized only by the symptoms that it induces, and in these cases the stomach and bowels should be thoroughly washed and pilocarpin be administered cautiously.

Anrep obtained small quantities of ptomatropin from bad fish, and he states that 0.2 milligram (gr. $\frac{1}{300}$) of the hydrochlorid of this base is sufficient to kill rabbits. Schmidt states that 100 grams (3¼ ounces) of decomposed sturgeon yield 3 milligrams (gr. $\frac{1}{2}$) of ptomatropin, a quantity sufficient to kill two men.

There may also be in putrid fish and in other meats putrefactive products that simulate in action curare, muscarin, and digitalin, but space will not allow of a more extended discussion.

## Ergotismus.

*Claviceps purpurea*, the fungus that grows as a parasite on rye and other grains, on which it develops its resting mycelium, designated as *Secale cornutum*, has long been known to be poisonous. With continuous and thorough cultivation of the soil this parasite disappears, and for many years ergotism has but rarely been observed, except in Spain and Russia. In certain sections of these countries extensive outbreaks of this disease have been reported. As ergot loses its poisonous properties after a few months, these epidemics have prevailed only during short periods after the harvests. In other countries isolated cases have been produced by the excessive and prolonged therapeutic use of ergot. Scarcely any other drug has been studied by so many chemists and with such diverse and contradictory results. Numerous attempts have been made to isolate the active principle or principles, but a preparation that has been heralded by one investigator as the possessor of all the virtues of the crude drug has been pronounced by another to be wholly inert. A full discussion of all these claims, or even the bare mention of all the preparations, would neither reward the writer for his labor nor benefit the reader. I shall therefore content myself with a statement of the results obtained by Kobert, one of the most recent and apparently the most successful student of the subject. Kobert finds in ergot three poisonous substances, ergotinic acid, sphacelinic acid, and cornutin; but as the first of these is not poisonous when taken by the stomach, only the others need to be considered. In all cases of ergot-

ism both the sphacelinic acid and the cornutin are taken in the ergot; therefore a clinical picture of the disease must be a composite resulting from the combined action of the two.

Sphacelinic acid is supposed by Kobert to be the constituent of ergot that causes gangrene, *ergotismus gangrænosus*, while he is inclined to attribute the characteristic effects on the nervous system, *ergotismus convulsivus*, more largely to the cornutin, although it is evident from its action that injury may be done to the brain and cord by the acid.

Sphacelinic acid induces gangrene of tissue with which it comes in contact in concentrated form. This accounts for the epithelial necrosis, the ulcers, and the hemorrhages in the alimentary canal. If the dilution be so great that actual gangrene does not result, changes less in degree but identical in character are caused. In this way result the degenerations of the walls of the blood-vessels observed in ergotism, and which consist of lessened elasticity and minute hemorrhagic extravasations, as in phosphorus-poisoning.

Grünfeld fed some animals with sphacelinic acid. In cocks, gangrene soon appeared in the comb, then in the wattles, tongue, wings, and crop. In hogs the ears become gangrenous and fall off a piece at a time. Dogs and cats generally die from gangrene which begins in the skin. Horses and cows fed upon grain containing ergot lose their hoofs, ears, and tails.

Krysinski has made post-mortem examinations of animals recently dead from the effects of ergot, and of those killed while suffering from this form of poisoning. The epithelial cells of the intestines are necrotic in patches, and as a consequence the germs normally present in the lumen penetrate the walls and induce ulceration. The mesentery shows numerous extravasations along the blood-vessels. All tissues, especially the subcutaneous connective tissue, are more or less icteric. Recklinghausen finds both in the walls of the blood-vessels and in their partially or wholly coagulated contents a marked hyaline degeneration by which the blood-corpuscles and nuclei in birds, also the different coats of the walls, are converted into a homogeneous, glassy mass which stains uniformly and intensely brown with potassium iodid, thus resembling amyloid. In the blood-vessels of the combs of poisoned cocks there are hyaline cylinders which do not fill the lumen and which are surrounded by normal blood; then the hyaline degeneration extends peripherally into the walls. Recklinghausen explains this fact by supposing that as a result of the first effect of the poison the blood-vessels are contracted, and the walls, together with the coagulated contents, undergo hyaline degeneration. Subsequently the walls dilate, leaving the hyaline cylinder, around which normal blood flows. The affected parts become coal-black from the deposition of an amorphous pigment the nature of which is not known, but which most probably results from changes in the hemoglobin. It is plainly seen that after the blood-supply to a part has been cut off by the formation of the hyaline emboli already mentioned necrosis follows.

According to Kobert, the second active principle in ergot is an easily decomposable alkaloid to which he has given the name "cornutin." This

does not seem to be identical with Tanret's ergotinin, which is crystalline, and which Kobert finds to be inert. Cornutin is found only in comparatively fresh ergot, disappearing more quickly than the sphacelinic acid. From this fact it happens that those symptoms due to cornutin are more prominent in outbreaks occurring soon after the harvests, while those due to sphacelinic acid occur in both early and late epidemics.

Cornutin is believed not to be possessed of any local action, but to act only through the nerve-centers. In the brain it is supposed to affect the vagus, vaso-motor, and convulsive centers; in the cord, the uterine center. It also seems to act as an irritant to muscular tissue. In its action on the vagus center the first effect manifests itself in slowing of the pulse; then, when continued irritation results in paralysis, acceleration of the pulse appears. Likewise irritation of the vaso-motor center causes an initial elevation and a subsequent depression in blood-pressure. Irritation of the convulsive center causes at first a sensation of formication, which in some epidemics of ergotism is the chief and persistent symptom. In many instances, however, the formication is followed by most severe convulsive seizures, which may persist for hours at a time. In their onset these seizures often bear a very close resemblance to those of epilepsy, and the victim of their frequent return develops the hebetude so frequently observed among epileptics. These nervous manifestations give to those epidemics of ergotism in which they appear prominently the designation of *ergotismus convulsivus* (Fig. 1). In these spasms the flexors overcome the extensors, and when they frequently recur permanent contractions may result. In some epidemics there is, in the intervals of the spasms, a burning pain in the joints, so excruciating that it may drive the victims, crazed with suffering, to seek relief by immersing themselves in cold water. Recovery is slow when it does occur, and often imperfect, leaving the contractions already mentioned, extensive muscular atrophy, especially of the arms and legs, formication, anesthesia, and mental weakness. Tuczek, who has described quite thoroughly the effects of chronic ergotism under the name of "ergot-tabes," shows that the conditions, both physical and mental, bear a close resemblance to those resulting from certain severe injuries to the brain and cord. The permanent contractures are due to atrophy of the extensors.

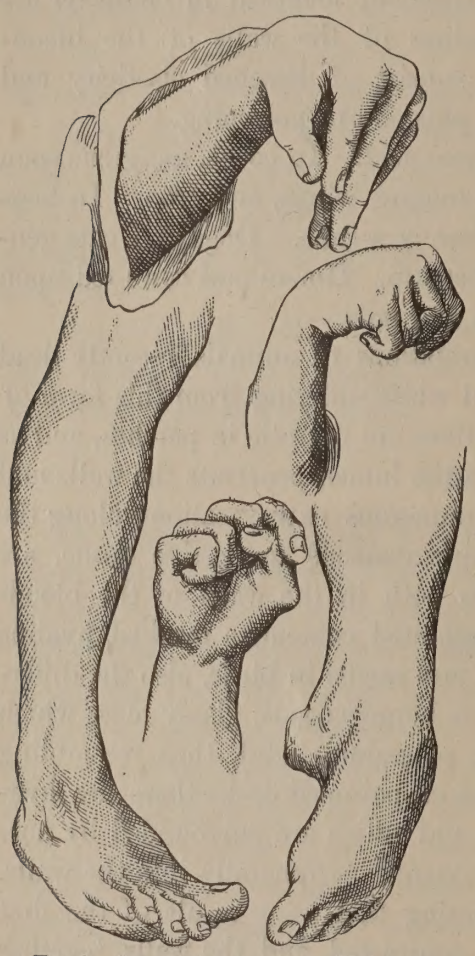

FIG. 1.—Convulsive ergotism (Kobert).

The symptoms of ergot-tabes do not differ from those of tabes dorsalis. The patellar reflexes are lost.

Irritation of the uterine center in the lumbar cord induces in pregnant women and in the lower animals severe and continuous labor-pains, causing abortion. The uninterrupted uterine contractions asphyxiate the fetus, and a still-birth results. There has been some discussion as to whether the uterine contractions are due to the action of the drug on the center in the lumbar cord or to a direct action on the walls of the uterus, but the researches of Hemmeter of Baltimore seem to show conclusively "that ergot in producing contractions of the uterus acts primarily and essentially upon the lumbar cord; that is, its action in causing peristalsis of the uterus is centric, not peripheral." The same investigator concludes that the action of ergot in increasing intestinal peristalsis and in causing contraction of the arterioles is in both instances centric; also that toxic doses of ergot cause a fall in blood-pressure by inducing vaso-motor paralysis.

Section in fatal cases of ergotism shows no characteristic changes in the abdominal and thoracic organs. The extensors of the limbs are atrophied. Microscopic examination shows a toxic polyneuritis, which is classed by Leyden among those forms of neuritis produced by lead, mercury, arsenic, phosphorus, carbon disulphid, carbon monoxid, and alcohol. Tuczek found in four cases hyperplasia and fibrillar metamorphosis of the neuroglia at the expense of the nerve-elements in the posterior columns of the gray matter. The alterations were found in the columns of Burdach, those of Goll being unaltered (Kobert).

As has been stated, the effects of ergoted bread and the symptoms due to the administration of the preparations of ergot in toxic doses are a complex of those due to sphacelinic acid and those induced by cornutin. The effects as reported by those who have studied epidemics of this form of poisoning may be briefly summarized as follows: There is at first formication in the toes and fingers; then these parts become numb and cold. Gradually the surface

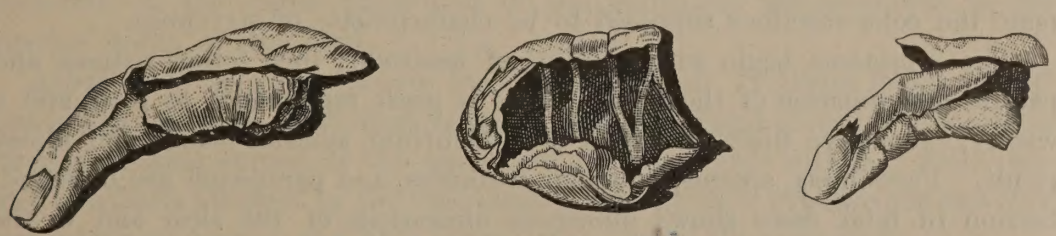

FIG. 2.—Gangrenous ergotism (Kobert).

begins to blacken, and the parts, becoming gangrenous, drop away a bit at a time, or a joint may dry up and be detached; in some instances entire limbs have been lost (Fig. 2). There is no suppuration and no bleeding, the gangrene being wholly dry, unless the drying tissue be infected with some pus-producing micro-organism. There is every degree in extent of the disease. Local gangrene in the intestines, with ulceration and sepsis, may simulate typhoid fever. The neuroses that have already been mentioned manifest themselves. Intercurrent diseases, as pneumonia, are frequent and fatal. Among the poor

people who suffer from epidemics of ergotism in Russia typhus fever has in several instances been the direct cause of a large number of deaths.

The treatment of ergotism has not been very satisfactory. Large doses of calomel are employed in the beginning for the purpose of cleansing the intestines and preventing ulceration. Salol and other germicides are also given. Chloral and the bromids are used to prevent repeated convulsions. Amputation of the gangrenous extremities should be delayed until a line of demarcation becomes well marked, and in the mean time infection should be prevented by strict attention to asepsis. The contractions of the limbs are best treated by massage, electricity, and the mechanical appliances employed in orthopedic surgery. The mental derangements that result in some cases are best cared for in hospitals for the insane. Kobert recommends the scopolamin (the hyoscin of Ladenburg) chlorid subcutaneously in doses of 0.5 milligram (gr. $\frac{1}{130}$).

## Maidismus.

This affection is a form of chronic poisoning common in Lombardy, where as many as 56,000 cases were reported in 1881. It is caused by eating bread made from fresh corn-meal that has not been sufficiently dried, and which consequently has undergone putrefactive changes. The Italians call the diseased condition that arises from this poisoning *pellagra*, from *pelle*, skin, and *agro*, rough, because the skin becomes inflamed and rough.

According to Paltauf and Heider, the grains of corn become infected during wet seasons with the *Bacillus maïdis* and the *Bacillus mesentericus fuscus*, and these bacilli decompose the moist meal, producing maize-ptomains, which are the active poisonous agents. Lombroso has named a poisonous substance found by him in the corn-meal "pellagrocein," but this is probably a mixture of ptomains, some of which induce narcosis and paralysis, while others induce symptoms resembling those of nicotin-poisoning. Some of these ptomains are said to give with sulphuric acid and potassium bichromate the color-reactions supposed to be characteristic of strychnin.

The symptoms begin with a feeling of lassitude; then follow redness and painful inflammation of the skin. There is great repugnance to food, and a watery, exhaustive diarrhea comes on. Delirium, suicidal mania, and idiocy result. Paresthesia, spasms, muscular weakness, and paraplegia are observed. Section in fatal cases shows numerous ulcerations of the skin and in the intestines, and structural changes in the posterior columns of the cord.

Prophylaxis is secured by the careful drying of the meal in kilns. No beneficial curative treatment has been discovered.

## Lathyrismus.

The following statements consist of a translation from Kobert's work, *Intoxikationen:* By lathyrismus we mean an intoxication that was known to the contemporaries of Hippocrates, and which is caused by the seed of at least three species of the chick-pea or vetch. These are *Lathyrus cicera*, the

red vetch, *Lathyrus sativus*, the German vetch, and *Lathyrus clymenum*, the Spanish vetch. In Spain, France, Italy, and in certain parts of Africa and India there have repeatedly appeared, from the eating of the seed of the vetch, epidemics of a disease that especially affects males and which induces a transverse myelitis, with motor and sensory paraplegia. The paralytic symptoms gradually disappear, but there remains spastic tabes with heightened tendon-reflexes, attributed by Proust to secondary degeneration of the lateral columns, while Strümpell considers the disease a typical spinal paralysis. However, the symptoms may wholly disappear and recovery be apparently complete. Men and animals, especially horses, are affected in the same manner. Duvernoy described the disease in 1770; Doir saw it follow the eating of vetch-bread in 1785; Despranches observed it in France in 1829, and Pellicotti in the Abbruzzo mountains in 1847. Reports of the disease were made by Irving in India in 1861 and 1868, and by Bourlier in Africa in 1882. In 1883, Marie published in *Le Progrès Médical* a review of the literature of the subject, and more recently Schuchardt has done the same.[1]

The best clinical picture of the disease has been given by Cantani, who excised small bits of muscle and found the transverse striation less marked than normal, with a deposition of fat-drops. Complete post-mortem section of men, with histologic examination of the organs, has not been made.

Hogs are killed quickly by the vetch. Horses suffer from paralysis of the recurrent laryngeal nerve, necessitating tracheotomy. More chronic poisoning causes paralysis of the posterior extremities, and death. Méricourt believes that the disease beri-beri is due to a similar intoxication, but this is denied by Marie and others. In horses there is atrophy of the muscles of the larynx, especially of the cricoarytenoideus posticus and lateralis, also of the thyroarytenoideus. The left recurrent laryngeal nerve is much wasted. Microscopic examination shows the muscle greatly atrophied, without striation, and undergoing fatty degeneration. In the central nervous system one finds atrophy of the ganglion-cells in the vagus center and of the multipolar ganglion-cells in the anterior horns of the cord.

Attempts to isolate the poison have not succeeded. Teilleux found an acid that induced typical effects upon rabbits. Bourlier found an active alkaloid in the alcohol-ether extract of the seeds, and poisoned birds with it. Astier isolated a volatile alkaloid by the Stas method, and he thus explains the fact that long-continued heating at a high temperature renders the seeds inert.

[1] *Deutsches Archiv für klinische Medicin*, B. 40.

# MILK-SICKNESS.

By AUGUSTUS A. ESHNER.

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The disorder known as "milk-sickness" is an affection observed in certain localities, and resulting from the ingestion of meat or milk (or its products, butter and cheese) obtained from cows suffering with a special form of infection, of which trembling is a prominent symptom. The disorder is in all probability a form of food-poisoning. It is encountered in the Southern and Western United States (more so formerly than now), and it appears to prevail in recently settled places, disappearing when the soil has been brought to a certain degree of cultivation. The first signal of the affection in animals is said to be a failure of the milk to form foam when shaken. The disease is acquired by human beings through the use as food of the flesh or the milk of infected animals. The most pronounced symptoms of the disorder are fatigue, languor, headache, thirst, anorexia, nausea, vomiting, pyrosis, a peculiar odor of the breath, epigastric pain, abdominal pulsation, and constipation. The temperature is not elevated (it is often subnormal), nor is the pulse accelerated. The skin is dry, while the tongue is moist and coated. Respiration is labored and sighing. The abdomen is retracted, but not tender. Delirium is rare. In fatal cases the prostration gradually increases and coma develops. Should recovery ensue, convalescence is likely to be tedious and prolonged. The treatment of the condition in man is symptomatic and sustaining. Of course the offending cause is to be withheld, and to be replaced by proper food of reliable quality. The secretions are to be maintained and constipation should be overcome by appropriate remedies. Alcohol, quinin, and strychnin will, as a rule, be found to be indicated, in addition to a simple and nutritious diet. Opium may be required to control irritability, and gentle counter-irritation in the epigastric region, as with a mustard plaster, may meet indications in individual cases. Convalescence may be hastened by change of residence to the seaside or to the mountains or by a sea-voyage.

# DRUG-HABITS.

By CARL FRESE.

## The Opium-habit; Chronic Morphinism.

It is undoubtedly true that of intoxicating stimulants alcohol claims by far the majority of victims among the Caucasian races. With them it is the staple stimulant, and too often it is indulged in excessively and habitually, leading to alcoholism in its various forms. The people of Asia (China, India, Persia, Turkey), instead of alcohol, employ opium. There the majority of opium-eaters and opium-smokers do not suffer any serious consequences from the practice, and only when opium is used excessively do grave evils result.

From Asia and Turkey opium-eating and opium-smoking have been introduced into Europe; from China,[1] into America. But among Caucasians habitués of opium, who either take crude opium, smoke opium, drink laudanum or nostrums containing opium, or employ suppositories, are in a small minority as compared with those who use morphin hypodermically. The condition of mental and physical disease termed "morphinism," induced by habitual poisoning from injecting morphin, is the one that chiefly claims our attention, the more so as the disastrous effects of opium are referable in the greatest extent to the morphin contained in it.

**Definition.**—Morphinism is a disease both of the body and the mind, caused by chronic poisoning by morphin. When the disease is developed there exists an irresistible craving for the drug, and it is this artificial appetite that is the chief difficulty to be overcome in the treatment.

**History.**—The history of opium-eating is old. Morphinism is of comparatively recent origin, and coincides naturally with the introduction of the hypodermic method of medication. In 1864 the first case was reported in which the hypodermic injection of morphin had induced the condition we now term "morphinism." Dr. Bertrand[2] was the first who published a case in which morphin was used hypodermically, the patient being the wife of Dr. Wood of Edinburgh, who taught the method to Bertrand. Bertrand[3] remarks

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of the means resorted to; otherwise the victims may be of excellent moral character. It is seen, therefore, that the craving or appetite for the poison is the cardinal point in the whole horrible habit, and, as already mentioned, the physician will have to devote his energies chiefly against this craving, and in trying to overcome it he will find the greatest difficulty.

It must be granted that in some persons a disposition to morphinism exists. In how far heredity plays a rôle in this connection must remain an open question. Whether morphinism is merely a vice, or is a mental defect coming under the head of insanity, may also be disputed. It seems, however, that normal individuals are not inclined to become morphinists; otherwise it would be almost criminal for physicians to give morphin hypodermically for any length of time, even if other indications should make such a course desirable. Erlenmeyer says, with regard to this question: "The disposition of morphinomania shows itself in a very remarkable reaction of those disposed to morphin. While in normal individuals an injection of 1 to 2 cgm. ($\frac{1}{6}$ to $\frac{1}{3}$ gr.) of morphin causes malaise and nausea, generally even induces vomiting, and then brings sleep which, after waking, is followed by a certain sense of discomfort ("Katzenjammer"), all these symptoms are absent in those disposed to it. For these morphin only possesses an agreeable, stimulating, vitalizing, euphoric effect." "The patient induces by the injection a wonderful inebriation or half-sleep which helps him over many sorrows of life, and agreeable sensations pervade his whole body. Others feel after the injection fresh and elastic as never before; only after the necessary dose of morphin are they able to think and to work" (Fiedler). "The morphin injection causes a state of pleasurable excitement which finds its analogue only in alcoholic stimulation. The mood changes; the sad man becomes gay, the weakling strong and energetic, the silent one waxes eloquent, the timid bold; self-consciousness of individual power and ability is increased" (Levinstein). "These conditions, up to now foreign to the individual—namely, psychic well-being, increased ability to work and endure—soon acquire a demoniacal power over the victim, so that he passionately desires morphin and longs to obtain and enjoy it. Temperate use soon degenerates into excessive indulgence. The person so disposed is resistlessly enslaved by morphin, and even the person of firm will is soon subject to the demon."

The fact that people become accustomed to doses that are very much larger than the usual lethal doses requires special explanation. In acute poisoning morphin is a cardiac poison (Binz). In chronic poisoning morphin is a nerve-poison, and the deleterious effects are chiefly exerted on the central nervous system. Besides this effect on the nerves a local effect occurs. Morphin is excreted through the stomach and with the saliva. In the stomach it causes a general disturbance of function, leading to gastric catarrh.

The question of what becomes of the morphin in the body is of such great importance that it is necessary to consider it here a little more fully. Only when we know what becomes of it will we be able to treat the symptoms of abstinence on a rational basis. Marmé showed that morphin injected subcu-

taneously is excreted partially through the stomach and partially through the intestines. Stolnikow and Rosenthal found morphin in the saliva. Great difference of opinion prevails with respect to the excretion of morphin in the urine. This diversity is probably due to the fact that morphin partly passes over into the urine without decomposition and partly is oxidized in the organism. This product of oxidation is called "oxydimorphin." The dangerous symptoms occurring when a morphinist is undergoing treatment—that is, when the accustomed large doses of morphin are diminished—can, of course, not be due to poisoning by morphin. This great error, however, is often made, and antidotes to morphin are administered, of course without success. Marmé in 1883 suggested a very plausible hypothesis of the causation of the abstinence-symptoms during the withdrawal of morphin. He attributes these symptoms to poisoning by oxydimorphin. He found this substance in the lungs and livers of animals that he killed after having given them for some time subcutaneous injections of morphin and isolated oxydimorphin in the pure state. After injecting certain doses of it in dogs, he found the following symptoms: retching, vomiting, audible and apparently painful peristalsis, diarrhea frequently with bloody stools, rapid pulse without paralysis of the vagus, sinking of the blood-pressure and dilatation of the peripheral blood-vessels, lowered temperature, and collapse-like weakness. These symptoms are exceedingly similar to those that follow abstinence from morphin by habitués. "The morphin-injections which have been continued for a long time in morphinists cause the formation of oxydimorphin in the organism. This begins to show its toxic action, then, always when the effect of morphin ceases. It occurs both during the period of morphin-use, when the effect of the single injection is exhausted, and during the treatment for removing morphin. A renewed injection of morphin neutralizes the effect of the oxydimorphin. Morphin is therefore an antidote of oxydimorphin." Marmé says that only a part of the morphin is converted into oxydimorphin. It thus follows that the dose of morphin cannot by itself be of importance, for this would only be the case if all the morphin were oxidized. "The oxydimorphin causes the abstinence-effects as soon as it is formed in greater abundance. This more abundant formation can only take place if morphin has been taken for a long time, because only a part of the morphin is oxidized."

There exists no pathologic anatomy of morphinism, because the changes *post mortem* in the bodies of morphinists cannot be brought with certainty in causal connection with morphin (Erlenmeyer).

**Prognosis.**—The prognosis of the morphin-habit is bad; that is to say, although a patient may be weaned from the use of the drug, and although the untoward symptoms arising during the withdrawal are scarcely ever fatal, yet the great majority of morphin-habitués relapse sooner or later, and their lives are ended prematurely in consequence of the debilitating influence of the poison. Erlenmeyer makes the prognosis absolutely bad, and most other authorities, although not quite so skeptical, come to scarcely more favorable

conclusions; and my own experience with these cases compels me to agree with the observers mentioned. It would seem, therefore, when one is called upon to treat a case of morphinism, while there is little hope of effecting a complete cure, so much can be done for the sufferer, and the immediate results of restoration to comparative health and usefulness, even if the restoration be not permanent, are so striking, that one should use his utmost endeavors to rescue the deplorable victim.

**Treatment.**—Generally speaking, four methods of weaning patients from the morphin-habit are in vogue. Of these, the one most commonly used is the rapid gradual method. The others are the sudden, the slow, and finally the substitution-method. The sudden method was proposed by Levinstein. The originator of the rapid gradual method is Erlenmeyer, who is probably the greatest living authority on morphinism and its treatment. His monograph is the most complete work on this subject, and ought to be studied by every one wishing to obtain full information on this important question. Levinstein's method consists in absolutely stopping the supply of all morphin suddenly. It has the advantage of effecting a cure in the shortest space of time. This, however, is its only advantage, and the disadvantages, not to say dangers, are so great that it is doubtful whether this treatment ought ever to be adopted, except, perhaps, in cases in which the habit has existed for a very short time, and the patient's general health has suffered very slightly and he is able to stand the constitutional strain. The abstinence-symptoms, more fully to be described later on, are seen here in their utmost severity. Collapse so grave as to threaten life occurs with alarming frequency. This treatment, therefore, has generally been abandoned.

The slow method consists in reducing the accustomed dose of morphin every day by a very small fraction, so that the patient experiences the minimum of discomfort. In consequence the abstinence-symptoms are diminished as much as possible and the subjective well-being of the patient is least interfered with. As an offset to this, the time consumed by the cure is inordinately prolonged, by which, of course, the expense of the method is very much increased. A much more serious objection, however, to which Erlenmeyer calls attention, is that the prolonged treatment weakens the patient much more than a rapid withdrawal, in which the individual suffering is more intense but much shorter in duration. The human body can endure a sharp siege of suffering much better than a prolonged period of chronic irritation. Apart from this, the patient feels pretty well when the dose has reached a comparatively small amount, and he imagines that he is now able to overcome the remaining little by himself; so he leaves the sheltering institution in which the treatment has been carried out, only to relapse rapidly into his former bondage.

The substitution-methods consist in giving the patients other medicines while reducing and finally withdrawing the morphin, the intention being to stop these substitutes as soon as all the morphin has been abandoned. Unfortunately, however, we do not possess a drug or a combination of drugs that

will overcome the morphin-habit without establishing a craving that is, if possible, worse than the original evil. The bromids, alcohol in its various forms, cocain, hyoscyamus, belladonna and its alkaloid, crude opium, and other medicines have been tried, with most unsatisfactory results. Of these substitutes, cocain has proved a veritable curse, the combined morphin-and-cocain-habit being the most disastrous of all the forms of narcomania. Later on, in dealing with the cocain-habit, it will be shown that most, if not all, the cocain-fiends combine the two drugs, and this combination is conducive to the use of enormous doses of both poisons. Very few people, if any, commence with cocain, the order being alcohol, morphin, cocain. It must therefore be considered very bad practice to give cocain with the hope of overcoming the morphin-habit. Alcohol, too, offers very few advantages; generally, morphinists are also alcoholics, and whether the alcohol-habit is preferable to the morphin-habit is a question that will probably be answered by the majority in the negative. It is unnecessary to go fully into a discussion of the actions, effects, and disadvantages (for advantages there are none) of the various other substitutes occasionally recommended; suffice it to say that they have all proved unsatisfactory. The general verdict, therefore, is that the substitution-methods have failed, and consequently are not to be recommended.

The remaining mode of curing the morphin-habit is that briefly designated as the rapid gradual, or Erlenmeyer's method. The names indicate the chief principle and its originator. By this method the morphin is reduced very rapidly, but at the same time gradually. This treatment can be carried out satisfactorily only in an institution properly equipped for the purpose. It has some inconveniences, but it offers the greatest prospect of rapid cure, the least danger to life, and it has, in addition, the advantage of being less expensive than most of the other cures, because the time of treatment is materially reduced. The actual time in which the morphin is absolutely cut down to *nil* amounts to not more than a week or ten days, and the remainder of the time the patient has to spend in the institution can be devoted to strengthening him. This strengthening treatment is of the utmost importance, for the time immediately after the morphin has been stopped is the time of all others when the patient is most liable to relapse. From six weeks to two months is the time that a morphinist should make up his mind to spend at an institution. Let the first two weeks be devoted to breaking off the morphin totally, and the rest to breaking off the habit. The habit, as has been said repeatedly, is the crucial point. The six weeks after the morphin has been stopped are but a very short space of time in which to fortify the *morale* and the will-power of a person who has been a victim of this habit for, it may be, many years.

Erlenmeyer's method is the one to be recommended. We shall therefore go somewhat fully into the details of this mode of treatment. It may be best to take a typical case and follow up the various stages methodically. Most patients are unable to state exactly how much morphin they take within twenty-four hours. If much work has to be done, many injections are made; if the patient is at leisure, the dose may be reduced to half, only to be increased

again the next day by probably large amounts. The statements of the patient as to the quantity used are unreliable. The one fact remains, that he always injects more than he actually needs to feel competent to perform his usual work. The fact that a great many patients generally lie about the matter is constantly to be kept in mind. They will intentionally state the daily dose at a much higher figure when they are about to enter an institution, in order to have, as they imagine, less suffering when the physician reduces the stated dose. When a patient enters an institution he is free from all social and business cares, and therefore does not need as much morphin as before. To find out the dose that a patient actually requires, and to give him this dose for some days before starting the withdrawal, is called by Erlenmeyer the "morphin-equilibrium." To ascertain this a small dose of morphin is given, and followed by the next dose only when the effects of the first diminish. Two or three days suffice to establish two facts: first, the usual dose of morphin is considerably diminished; secondly, the dose necessary for comfort is definitely ascertained. As already stated, the statements of the patient are absolutely unreliable, and his psychic condition is so abnormal that special precautions have to be taken by the physician in order to be able to get an objective view of the case. It is therefore necessary to prevent the patient from obtaining morphin or any other drug without the knowledge of the physician. This can be accomplished in an institution by removing the patient altogether from the articles that he has brought with him and by having him nursed by perfectly reliable attendants. To fulfil the first of these conditions, the simplest method, as described by Erlenmeyer, is as follows: "I leave to the patient all his belongings; I do not touch them and do not look at them, and allow him to make himself comfortable in his room. At the time when the affair becomes serious—that is, when I have to be absolutely sure that he receives morphin from me alone—I bring him with surprising suddenness into a room in which he has never been before. In my presence he is rapidly undressed; his clothes are immediately returned to the first room. I then examine his nude body (for morphin under plasters), I give him a fresh nightshirt, and have him put to bed. From this moment a nurse remains constantly with him; nobody has access to him; for some days he is completely shut off from everything, even his mail. The room in which the patient has first lived, and where all his belongings and clothes are, is locked and the key remains in my pocket. The patient is not allowed to leave the bed under any pretence. Proper organization of the institution provides service, nourishment, removal of the evacuations, etc., so that the nurse is never obliged to leave the room. The nurse[1] has, of course, to be experienced and reliable, and must be frequently relieved. In the sick-room there should be a handy apparatus for preparing rapidly some warm drink. The nurse may have with her a syringe filled with a solution containing 0.02 gm. (gr. $\frac{1}{3}$) of morphin, which, however, she is to use only in sudden and dangerous emergencies. Furthermore, it is important that the sick-room can

[1] Erlenmeyer prefers female nurses.

be heated. Many patients become very sensitive to changes in temperature when the dose of morphin is reduced, and great alleviation can be given to them by heating the sick-room. Even in the height of summer this has often been done with the greatest success. The daily dose of morphin is given in three, rarely in four, portions at stated intervals, and the evening dose is preferably between ten and eleven o'clock, in order that the good effect may be produced during sleeping hours. This evening dose is continued the longest.

"If in any way possible, the patient is induced to take food after each injection, for at that time he is able to do so more than at any other. The frequent and generous administration of very nourishing food is to be urgently recommended from the start. But alcohol in any form is to be used with care. The patients, indeed, are mostly accustomed to far too large quantities of alcohol, and it is generally best to allow but a moderate amount, in spite of the incessant pleading for more. It has always been found that those that drink much have the most coated tongues and the greatest aversion to all warm foods, and that they recover, after the termination of the withdrawal proper, much more slowly than temperate people. Brandy, punch, port-wine, and other heavy drinks ought not to be used at the commencement of the battle, but should be reserved for the last grave hours of the cure, when they are able to produce their tonic effects.

"The advantages of this method, compared with the others, are as follows:

"1. Certainty of success and prevention of secret administration by isolating and watching the patient.

"2. Absence of danger.

"3. Short duration.

"4. Prolongation of convalescence."

Hitzig in 1892 published a method to overcome the most violent abstinence-symptoms, which consists in regularly washing out the stomach after a trial-breakfast, in order to remove the morphin excreted through this viscus; secondly, to wash out the stomach during the stage of hyperacidity with Carlsbad-salts solution, in order to neutralize this condition and therefore to mitigate the irritating effect of the hydrochloric acid on the nerves of the stomach. He treated one case in this way, and found, to his surprise, that not only the gastric symptoms but nearly all the abstinence-symptoms were almost altogether absent. Erlenmeyer modifies Hitzig's method, and has tried to neutralize the gastric hyperacidity at the end of the cure without using lavage, which is at best a rather disagreeable procedure. He used the strongest alkaline soda-water in Germany—namely, the Faschinger—of which he gave about a liter (quart) during the day. This method has been tried by Erlenmeyer in fourteen cases, with surprisingly good results, similar to those obtained by Hitzig.

We may here revert to the much-discussed question whether a patient suffering from morphinism should be removed to an institution or be treated at home. The weight of authority seems to be in favor of the treatment being carried out in a special institution. If the patient is undergoing treatment

and at the same time is allowed to have unrestricted liberty, the temptations to obtain morphin are so overwhelming that he generally succumbs to them. In patients who command much money it may be possible to have the treatment carried on at home by having a medical attendant live in the house and by having at least two trained nurses, but of course the danger of the patient bribing the attendants always exists, and absolute supervision is practically impossible. Apart from the fact that the treatment at home is not very promising as regards the cure of the patient, the task of the physician who attempts to treat such cases is most thankless and annoying. It is therefore recommended to send cases of morphinism to institutions; but the selection of these is a matter of some difficulty. A general hospital is not a good place, because the minute supervision necessary cannot generally be obtained. Institutions for the care of such cases, however, are quite numerous, and it is essential to be very careful in choosing a private hospital. Especially ought the character of the physician in charge to be well known. Medical men who have once been victims of the habit and have then opened asylums, basing their ability to treat cases on the plea of personal experience, are to be shunned, for, as we have seen, the disposition to become a morphinist proves the person so afflicted not to be of a well-balanced mind, but lacking that firmness of character which is the absolute *sine qua non* for one who ventures to treat this most difficult condition. It seems scarcely necessary to allude to the institutions conducted by persons who advertise or who are otherwise outside the pale of respectable medicine; still, such places flourish. An interesting article by Mattison[1] cites the investigations of the Massachusetts State Board of Health, which showed that all the advertised nostrums for the cure of the opium-habit or the morphin-habit contain opium or its derivatives except that of the infamous Keeley institutes, the gold-chlorid solutions. It is needless to state that the latter not only contain no gold, but, strange to say, also no morphin.

*Abstinence-symptoms and their Special Treatment.*—A train of evils termed "abstinence-symptoms" make their appearance soon after the treatment of weaning the patient from the morphin-habit has been instituted. The most conspicuous of these symptoms are yawning and sneezing. These are soon followed by irritation of the eyes, usually with lacrymation, and general nervous excitability followed by insomnia; the appetite is much diminished; fetor of the mouth is marked; and diarrhea sets in. If, under these conditions, morphin is still withheld, more dangerous complications ensue, the most alarming of which is collapse, with cold, clammy skin, extremely weak and rapid pulse, and total unconsciousness. This condition must, of course, be carefully differentiated from alcoholic stupor, to which these patients are liable if they have indulged in the excessive use of alcoholic stimulants in order to banish the disagreeable sensations induced by the enforced abstinence from the accustomed dose of morphin. In this condition the patient also loses consciousness suddenly, the respiration is stertorous, the skin is flushed, the conjunctivæ are injected; but the pulse, being full and bounding, gives the

[1] *Journal of the American Medical Association*, 1886, vii. p. 568.

best clue to the cause of the collapse. The only successful remedy for the collapse due to the withdrawal of the accustomed morphin is the immediate administration of a full dose of morphin hypodermically. Collapse that may end in heart-failure occurs only when the morphin is withdrawn suddenly. Under other conditions the complication may be avoided with care. If collapse does occur, other stimulants, as ether, alcohol, etc., are of no use. In addition to the injection of morphin, as already mentioned, friction must be applied to the skin, artificial respiration be practised, and electricity be used.

Delirium may also occur, but does so mostly during the sudden withdrawal, and must be combated by isolation, judicious restraint, and rather large doses of morphin. The slight delirium occurring during the gradual cure needs no special attention.

Vomiting usually passes away rapidly, but may be treated with demulcent drinks, effervescing waters, black coffee, and hot applications to the *scrobiculus cordis*. If the vomiting should be so obstinate as seriously to threaten nutrition, morphin is indicated.

Diarrhea, usually associated with abdominal pains, occurs generally at the start. As long as it is not too violent, it may be allowed to continue, because the morphin is thereby excreted more rapidly. The ordinary remedies may be tried, as lead acetate, bismuth, and tannic acid, but in severe cases opiates are indicated.

Neuralgia occurs very frequently, especially pains about the joints and in the calves. There are many other neuralgic manifestations in various locations that are very obstinate. Their treatment is rather unsatisfactory, but they disappear with the improvement in the general condition.

Biliary colic is common, and can be treated only with injections of morphin. Dysmenorrhea and menorrhagia occur generally during the cure, but the pains usually yield to antipyrin. Ergot and tampons are also useful. General restlessness usually increases toward evening, and is best treated by prolonged warm baths or wet packs. The bromids may also be given.

Insomnia is the most troublesome symptom for both patient and physician, and its treatment is very difficult. The medicines usually given are chloral hydrate, paraldehyd, sulfonal, and trional, either singly or in combination. The danger is that if these drugs are given for some time the patient may become accustomed to them. Hypnotism also has been recommended, but the results are very doubtful.

Insanity must be treated by confinement in a special hospital. Hysteria often occurs, and must be treated on general principles.

*After-treatment.*—After the special cure has been completed the condition of the patient is by no means normal. As was said at the beginning, the greatest difficulty in the treatment of the whole affection is the abnormal desire for some narcotic. This craving is not a bodily affection, but one of the mind, and experience has taught that this condition, which may be called either a disease or a vice, is nearly, if not absolutely, incurable. The best safeguard to prevent a patient from relapsing into the morphin-habit after he

has left an institution is the society of a reliable member of his own family or of a friend, who is to keep the patient constantly in sight and by his moral influence to strengthen the patient's weakened will-power. Work that gives the patient satisfaction is of the utmost value in preventing relapses. It is easy to understand that very often, unfortunately, the circumstances of the patient will not permit all this. It follows, therefore, that the principle of the treatment is to devote the shorter time to the withdrawal of the drug and the longer to the after-cure.

Erlenmeyer mentions that he has frequently been asked whether marriage after completed cure would not prevent a relapse. He answers: "I must warn against this, for, in the first place, matrimony is not an insurance company against morphinism, and, further, there is danger that the convalescent may seduce the other party into a misuse of the drug. Only after a space of two years in which no relapse has occurred may marriage be permitted."

### Chronic Cocainism.

Cocainism, or poisoning with cocain, induces a complication of bodily and mental disturbances. Its appearance dates back only about ten years, when this drug was first extensively employed in medicine as a local anesthetic. Most of the victims probably received their first doses from physicians, and special care in prescribing it is necessary, as cocainism is by far the most deleterious of all the forms of narcomania. It is nearly always a concomitant or a sequel of morphinism, very few cases of pure cocainism having been reported.

The effects of cocain are, at first and with moderate doses, particularly pleasant and seductive, as the general mental and bodily vigor is increased and no evil consequences follow. After repeated use the pleasant effects are soon followed by a feeling of intense depression, with anorexia, insomnia, hallucinations, and delusional insanity.

Cocain is very swift and short-lived in its toxic effects, but above all drugs it secures an abiding mastery over the taker in by far the shortest time. It is mostly used hypodermically. The symptoms are chiefly those of intoxication. The pulse is increased in frequency, respiration is disturbed, and perspiration is often profuse. A prominent symptom is rapid loss of weight. The patients are frequently pale in appearance, the eyes are sunken, the muscles are flabby, and the free borders of the finger-nails assume a brown tinge.

The evil effects of cocain on the mental condition are even more marked than those on the bodily functions. Persistent insomnia very rapidly ensues, and is soon followed by hallucinations of persecution which take most dangerous forms, either attacks being made on persons or the patient committing suicide. When such a stage is reached the only safe place for the victim is, of course, a hospital for the insane.

Particular attention has been drawn to a curious hallucination of sight in which the patient sees black spots on plain surfaces, as a white wall, and crawling vermin on table-cloths and similar articles.

Many abnormal cutaneous sensations are noticed. The patients declare that little animals are in their skin, and they show the openings through which these animals have penetrated. Erlenmeyer tells of a patient of his, a physician, who showed him the "cocain-bug" under the microscope.

A conspicuous psychic manifestation is an abnormal volubility in conversation and correspondence, so much so that one can often make the diagnosis of cocainism from the letters of the patients. In consequence of this peculiarity, these individuals never finish what they are about, although they work continually.

The **prognosis** of cocainism is even worse than that of morphinism, and it is doubtful whether a cocainist can be cured unless he is confined in an institution for at least four or six months.

**Treatment.**—The most dangerous symptoms of cocainism are those of poisoning by cocain. If the drug is withdrawn, no abstinence-symptoms appear, as with morphin; therefore the treatment ought to consist in the immediate and total withdrawal of the drug, unless the doses are very large (1 gram—gr. xv—or over). In the latter case the cocain is stopped in two stages. The patient must be kept in bed and watched with very great care, as he generally becomes very violent in consequence of delusions of persecution.

Attention must be given to the heart, which usually needs stimulation with alcohol, caffein, camphor, etc. Hot baths are contraindicated because of their depressing influence. The nutrition of the patient should be maintained at the highest point possible, and this is facilitated by the fact that the gastric symptoms of cocainists are not so severe as those of morphinists.

As already stated, the symptoms, including the hallucinations and the delusions, disappear very rapidly, but the delusional insanity persists the longest. As the patients are able to conceal their abnormal mental state, particular attention must be paid to this point, in order not to be taken off one's guard, with possibly disastrous consequences.

## Other Forms of Drug-habit.

Alcohol and opium and its derivatives are the poisons that enjoy the greatest popularity as habitual stimulants and narcotics, but there are a number of other drugs that cause those using them to become habitués. Most of these individuals suffer from hereditary predispositions or have been alcoholics or morphinists, and their morbid appetite has led them to try other stimulants.

Of these drugs, **chloral hydrate** is the one most widely used. The primary cause for taking it is generally insomnia. Chloral is debilitating to the heart, causing muscular weakening, nervous irritability, and erythematous skin-disease. Unlike morphin, the accustomed dose cannot be increased with impunity, several cases being on record of habitués who have died from slightly larger doses than they had been in the habit of taking regularly.

The *treatment* of chloral-poisoning—and this is the condition that has most frequently to be treated—consists in the application of warmth to the

body (Stricker and Lauder Brunton) by means of blankets, hot bottles, and hot drinks, preferably coffee. Cardiac stimulants must also be administered. The habit itself must be treated by withdrawing the drug suddenly; no abstinence-symptoms of any gravity occur. The after-treatment should be tonic and stimulating (strychnin, etc.). Alcohol ought to be used with caution, as the patients are prone to become alcoholics.

**Ether** is used as a stimulant and narcotic in certain sections of Ireland, where its abuse commenced in consequence of the temperance crusade of the famous Father Mathew. People accustomed to alcohol asked physicians for something to stop their craving; ether was prescribed, and soon was indulged in excessively. An ether-drunk is a very rapid affair. The successive stages of increased bodily and mental activity, delirious excitement and inco-ordination, and absolute unconsciousness, with subsequent nausea and depression, pass off in from three to four hours. This habit is on the decrease in Ireland, but there are cases on record of women and physicians elsewhere having become victims.

The *treatment* consists in the absolute withdrawal of the poison. The gastritis that always exists must be treated symptomatically. Strychnin, alcohol, and the bromids are also indicated.

The **eau-de-cologne** habit is chiefly indulged in by refined women, and is really a form of chronic alcoholism somewhat modified by the ethereal oils. It resembles chronic poisoning by absinthe.

The mountaineers of Styria take **arsenic** habitually (Roscoe). Women also indulge in arsenic-eating; with them this habit originates from the use of cosmetic preparations. Arsenic does not create a craving, properly speaking, but the habitués find it impossible to leave off, as the poisonous effects of arsenic supervene when the drug is discontinued. The *treatment* consists in gradual withdrawal of the arsenic and care of the gastric functions.

Cases of **paraldehyd-habit** and of **sulfonal-habit** have been recorded. The former has deleterious effects similar to a combination of alcohol and ether, while the symptoms of the latter resemble those of chloralism. The *treatment* in both cases consists in the rapid withdrawal of the drug and the administration of tonics.

**Antipyrin** has been misused lately. The symptoms are great nervous prostration, skin-affections, and heart-weakness. Rapid withdrawal of the drug and symptomatic treatment are the indications.

As curiosities may be mentioned indulgence in *petroleum*, producing hallucinations and emaciation, and the habitual use of enormous doses of *salts*, not taken for their purgative action (Kerr).

# CHRONIC INTOXICATIONS.

By ROBERT T. EDES.

## Alcoholism.

In the physiologic laboratory considerable differences may be observed in the poisonous effects of the different kinds of alcohol. Clinically these differences have no great importance, except from the fact that amylic alcohol or fusel-oil is present in the cruder forms of distilled liquor, and especially whisky, in sufficient quantities to modify their action considerably. This form of alcohol is undoubtedly a more powerful narcotic than ethylic alcohol, and more dangerous to life. By the process of oxidation, or "aging," it is transformed into comparatively harmless ethers.

In some respects the chronic drinker of brandy, rum, or good whisky may differ symptomatically from him who takes the same amount of ethylic alcohol in a more dilute form, hidden in the aroma of enanthic ether and the delicate bouquet of choice vintages, and which escapes the tests and the nomenclature of the chemist, while acids, sugar, and carbon dioxid undoubtedly modify the effects, both acute and chronic, upon the digestive organs and the nutrition. Practically, however, the difference in the forms of drunkenness depends, so far as the intoxicating agent is concerned, on the difficulty of introducing into the stomach in the weaker beverages so large a quantity of alcohol, in the same length of time, as may be done with the distilled liquors. When the amount of dilution is great, as in the case of beer or the lighter wines, the copious elimination by the kidneys and lungs checks the rapidity of the accumulation in the blood and retards its saturation.

Schemes for diminishing the amount of drunkenness by preventing the sale of "bad"—that is, raw—liquor are difficult to carry out, and at the very best could no more than possibly prevent a little ugly or fighting drunkenness, or, much more rarely, a death, in a case in which amylic alcohol would turn the scale against a man whom the milder ethylic compound would spare. The popular use of the lighter beverages, especially in connection with music and amusements, and in sharp contrast to the pernicious American habit of "perpendicular drinking," although a compromise, and as such to be looked upon askance by the strictest of moralists, is a move in the right direction, as offering a maximum of social enjoyment and a minimum of intoxication for a small amount of money. Much more, however, than upon the kind of liquor used do the different symptoms of alcoholic narcotism depend upon the personality of the user. *In vino veritas.*

**Acute alcoholism** of the milder grades, or the every-day drunkenness of the saloons and the streets, seldom calls for medical treatment, or is dealt with by the policeman or the experienced and long-suffering family. Quiet and fresh air are usually all that are called for. Ammonia will sober a man for a short time if it be necessary for him to pass muster or to exercise a temporary discretion. An emetic, if the stomach still contains alcohol and the poison have not proved its own antidote, will hasten recovery.

As narcotism becomes more profound the condition becomes more dangerous, and not mere matter for the ridicule or disgust of the bystander. The patient should be made to vomit, if he have not already done so, either by an emetic, like zinc sulphate or ipecac, or by a subcutaneous injection of apomorphin. Whichever is used, it will be advisable to rouse the patient as far as possible by mechanical means or by a cold affusion, in order that the nervous apparatus of the stomach may respond to the stimulus and that the drug may produce its due effect. He should then be allowed to "sleep it off" in an unconstrained position, with warm but not tight covering, in pure but not too cold air, and under careful supervision. If, as not infrequently happens, the patient has been picked up out of doors and exposed to the weather, the temperature should be observed and measures be taken accordingly.

Aside from the risks of a mistaken diagnosis, which are by no means insignificant, the practice of thrusting a person already comatose, or who may soon become so, into a remote, ill-ventilated cell, to get through his debauch as best he may, is a most dangerous and reprehensible one. Salutary and well-deserved as punishment may be, the death-penalty is much too severe to be exacted for a misdemeanor so strongly favored by municipal regulations and political influence.

The preparations of ammonia, as the aromatic spirit or even the ordinary aqua ammoniæ suitably diluted, may be given as stimulants by the mouth. In extreme cases strychnin or atropin may be given subcutaneously, or coffee by the rectum. If the breathing become dangerously weakened, the battery or artificial respiration may be needed. If the debauch have been a prolonged one in a confirmed drunkard, the administration of stimulants and nourishing food, like hot soups, after the immediate effects have passed off, will be a prophylactic measure of value against delirium tremens.

**Mania a potu**, or "crazy drunkenness," should, if possible, be treated only by such restraint as is necessary to prevent the patient from injuring himself or others. Chloral should be given only when it is absolutely essential to quiet the patient and when seclusion is impossible. Under these circumstances large doses may be called for, but are probably not devoid of danger, and their effects should be watched closely. Small doses are not likely to do much good. If the bromids can be administered in sufficient quantity, they would tend to reduce the excitement and would be less dangerous.

**Delirium tremens** may be considered as indicating the presence of subacute alcoholism, as it is of itself of brief duration, although representing an early stage of nervous breakdown. The fact that so many methods of treatment

have been employed with supposed success indicates that the condition is a self-limited one, terminating in a few days in recovery or in death—in the very great majority of uncomplicated cases in the former. The first question that arises in the presence of such a case is as to the propriety of stopping the supply of alcohol at once or gradually. The former plan is likely to be considered by the patient and sympathizing friends a dangerous one, but it does not appear to me and to others to be really so. As to its apparent cruelty, it may well be doubted whether, with regard to future immunity, it is desirable to bridge over the interval between debauches so smoothly that the patient never becomes aware of the advantages of real sobriety, and does not recover his full measure of self-control before he is again exposed to temptation. Hospitals might be mentioned that appear so anxious for the comfort, or the board-money, of their habitual clients that a condition of remittent rather than intermittent drunkenness is maintained. In almost all cases it is desirable and perfectly safe to cut off alcohol at once and completely.

When the alcoholic symptoms occur, as they not infrequently do, in connection with an acute disease, such as pneumonia, some modification of this precept is desirable, and the physician may then wisely employ alcoholic liquors for threatened heart-failure and low delirium for very much the same indications as would call for their employment in the case of a person not accustomed to their use. But as he is to be guided by effects rather than by measure, he will probably find himself obliged to use larger doses than in the latter case. The reformation may be left until a safer occasion.

In uncomplicated cases various drugs have been given to promote sleep, the absence of which is the most prominent and troublesome symptom. It has been very conclusively shown that opium pushed to the point of forcing sleep is a very dangerous remedy, while in smaller doses which fail of this effect it is of little or no value unless it may be called for by pain arising from some source more or less independent of the alcoholism. Chloral and potassium bromid in large but not excessive doses are probably the most useful agents for the promotion of sleep, and even in very large doses are often well borne. It is, however, better to wait one or even two nights for sleep rather than to force it at any cost. It was my practice, when seeing in the hospital a considerable number of cases of this kind, to limit the amount of chloral to be given in one night to 45 grains (3.), with double that amount of bromid, to be given in three doses. On one occasion a patient took by mistake over 100 grains (6.5), with the result of getting sound sleep, and without unfavorable effect.

℞ Chloralis, 10 gm. (ʒiiss);
Potassii bromidi, 20 gm. (ʒv);
Sodii bicarbonatis, 10 gm. (ʒiiss);
Syrupi cujusvis, 75 c.c. (fʒiiss);
Aquæ, ad 200 c.c. (fʒvi¾).—M.

Sig. A tenth part = 20 c.c. = 1 gram (15 gr.) chloral, + 2 grams (30 gr.) bromid.

I have had no experience with the more modern hypnotics in this disease, but would not expect from sulfonal, perhaps at present the most trustworthy member of the group, an effect sufficiently powerful to have great value in cases in which the nervous system is so completely deranged. Large doses of digitalis have been used, and were so by me in a few cases, with results apparently rather favorable than otherwise; but the method does not commend itself to my maturer judgment, nor has it obtained general favor.

The usual history of the development of a case of delirium tremens—the long drinking-bout, frequently a week's spree, with little or no food—gives us perhaps the most valuable hint as to its therapeutics, that is, supplying the patient with the largest possible quantity of easily digestible and nutritious food. A local gastric stimulant may well be combined therewith, and I was in hospital practice in the habit of prescribing frequent dishes of hot soup made additionally pungent with cayenne pepper. Any of the easily digestible wheat or wheat-and-milk foods so largely used in invalid-feeding at present, or milk alone, may be used in this way. Beef-tea may be used as a stimulant and to give a little variety to the bill of fare, but should not be allowed to take the place of substances having a much higher nutritive value. If the practitioner prefers to preserve the appearance of greater medicinal activity, he may administer the capsicum in the form of a bolus of 30 grains, or the tincture in smaller doses. It is considered by some writers that capsicum has a stimulant action upon the nervous system as distinct from that upon the stomach.

This treatment should be carried out steadily, and it will seldom fail to procure a sleep that, when it comes, is more restorative than that resulting solely from a powerful narcotic action. Other stimulants and heart-tonics may be called for.

In case of cardiac depression or weakness, ammonia, as aromatic spirit or the carbonate, may be used, as well as strychnin or atropin subcutaneously. Digitalis, if indicated, should be given as in any other case in which its action in regulating and strengthening the heart-beat is called for, and not in the excessive doses already referred to.

The question of prescribing alcohol might again arise, and there might be indications for its employment of exactly the same character as in a case not originating in its use; but under the circumstances it should not be given unless the practitioner be very certain indeed that nothing else will answer the purpose.

**Chronic Alcoholic Intoxication.**—The question of the proper treatment of chronic inebriety is involved with many others which have been, and probably will be for years to come, the subject of heated controversy resulting from extreme and unscientific views. Some of these questions are represented in the alternative, Is drunkenness a crime or a disease? The answer, in my opinion, is, as usual, to be found between the two extremes. For a large proportion of habitual drunkenness the individual is as much responsible as he is for any of his acts, and is as properly accountable to the law, which justly takes cognizance of his

condition so soon as it begins publicly to affect the rights and the comfort of others. But there is no reason why, as the cases begin to shade off toward the other end of the scale—that is, when each individual act is more or less the consequence of previous acts—a curative element as well as a punitive one should not appear in the regulation of the condition. Whatever views may be held as to responsibility, guilt, misfortune, or disease, the end to be sought, in the interests of society as well as of the culprit, is not to mete out abstract justice, but to prevent a repetition of the offence. This is to be accomplished by a system of increasing length of term of seclusion rather than by a frequent imposition of small fines (usually paid by those who have already suffered most) or by a confinement lasting only long enough to work off the immediate effects of one debauch and to leave the victim weak and ready for another. The latter and more usual plan is about as scientific as the treatment of chronic constipation, for instance, by irregular and powerful doses of castor-oil. Healthy and interesting employment is a highly important adjunct to the mere element of time that is necessary to the complete restoration of nervous tissue.

The statutory prophylaxis of alcoholism in large cities has so far proved little better than a farce. Where, however, it has a strong public sentiment behind it, in smaller and sparsely settled communities, it is of more value, but still far from being absolutely effectual.

While there is no doubt that alcohol, like other narcotics, weakens the power of resistance to renewed temptation, and that a time may come when the victim—through his own fault, it is true—is completely a nervous invalid and is to be treated as such, it is also evident that the application of the modern refined methods to the treatment of the crude mass of popular drunkenness would simply result in reducing a large part of the sober and well-behaved portion of the population to the position of attendants upon the vicious and the idle, who would be enjoying luxuries and consideration that they little deserve and which the rest of the community find it difficult to obtain for themselves and a serious burden to pay for for others.

Seclusion, whether punitive or therapeutic, should be reinforced by a liberal, well-cooked, and well-served dietary, and the time of the patients, so far as they are able, should be taken up with useful and profitable labor rather than with mere gymnastic exercises.

True dipsomania, or the insane impulse for drink, is only to a limited extent the result of chronic habitual alcoholism, and, like other forms of insanity, demands for its full development additional elements, of which heredity is undoubtedly the most important, though not the only one. It bears the same relation to chronic alcoholism that homicidal mania, for instance, does to ordinary reckless rowdyism and habitual disregard of life.

There is no reason to suppose that any drug can restore the self-control to the position it has lost. Other drugs may be substituted for alcohol with certain advantages as regards the manifestations of narcotism and decency of behavior, but most physicians would consider the transformation of a chronic

drunkard into a morphinomaniac by no means a desirable or hopeful one, and as marking a step away from a cure rather than toward it. The attempts to disgust a patient with his habitual beverage by the surreptitious addition of a depressing emetic like antimony and potassium tartrate are said to have been occasionally useful.

The basis of all successful treatment of inebriety must be moral reinforcement, sustained upon the one side by care of the bodily health, especially the digestion, and on the other side, according to the power of the patient to control his impulses, supplemented by physical restraint. The less of the latter the better, but in many cases it will be impossible to dispense with it.

Claims of cure of the alcohol-habit by hypnotism are frequently made, and there is no reason to doubt that they often rest on a substantial basis of fact. It is of course possible that such cures have been more speedy, as they would certainly be more dramatic, in effect than those wrought by the control of a stronger character, whether that of the physician or of another, over the normal or non-hypnotized consciousness. The second-named, however, are likely to be of a more permanent character, as deliberate and reasonable determination, if it can be obtained, is of greater weight, in most minds approaching the normal in character, than an impulse remaining from a vivid dream. Exactly what this controlling influence is and how it is to be acquired it is impossible to describe in scientific language, but it is that which all successful physicians, learned and unlearned, honest and dishonest, have been exerting ever since there were physicians at all, and long before the development of anything that could be considered as scientific psychology. It may be possessed by others, though, for the purposes here before us, some sort of a professional reputation, rational or miraculous, deserved or undeserved, undoubtedly aids in acquiring or retaining it.

The more strictly medical adjuncts to this essential basis are such as tend to the general building up of the system, and of the nervous centers in particular. Massage, bathing, exercise (which, as has been stated, may just as well be directed to producing some useful result), and mental occupation are, any or all, to be employed. It is always to be borne in mind, however, that the object in view is the restoration of the patient's will and his ultimate return to useful life, and not a mere relief of nutritive and digestive symptoms. The latter are not to be neglected, and laxatives and stomachic tonics are likely to be called for. It will be well that the latter should in no way suggest the narcotic that has made the trouble. Cinchona, gentian, and strychnin may be mentioned.

Hypnotics should be used with great caution, and, above all, should remain entirely in the hands of the physician. Under rare circumstances opium and cocain may be used, but never habitually or at the discretion of the patient, or even of an indulgent attendant. Time is a consideration of the greatest importance. When the delicate structure of the highly organized nervous tissue has been seriously impaired by the introduction of such a disturbing element as alcohol, weeks or months will be required after the disappearance of the

primary effects to get rid of the abnormal conditions and to restore healthy ones.

Fully developed dipsomania may demand prolonged or indefinite confinement in a hospital for the insane.

It would be a piece of affectation to treat as unworthy of mention the "cures," so popular at the present time, which are supposed to depend upon the use of gold. There is no reason to suppose that gold possesses any peculiar efficacy in the reconstruction of the nervous system, and it is highly probable that no one is better aware of this fact than those who ostensibly use it. It is my belief, though without having any inside knowledge of the matter, that such success as these methods have obtained—which, however, is far less than claimed—rests chiefly upon psychic, and but slightly if at all on pharmacologic, influence. In other words, these cures, when real, are "faith-cures" or "mind-cures," or such cures as many physicians who have the confidence of their patients are constantly accomplishing without humbug or mystery. A judicious use of strychnin, atropin, and cocain, which, as they remain in the hands of the physician and are unknown to the patient, cannot easily be abused by him, may possibly accelerate somewhat the process of freeing him from the early depressing effects of abstinence, but there is no reason to suppose that the permanence of the effect is altered thereby. The durability of the impression on the mind is the point to be gained, and it is possible that in some mental conditions the introduction of secrecy and deception aids in this direction.

The relations of chronic alcoholism to general paralysis of the insane are interesting and important, as the former may, on the one hand, counterfeit the latter with considerable precision, or, on the other, be one of the factors in its production. Hence the desirability of abstinence in a suspected case of this kind, for purposes of both diagnosis and therapeutics.

The treatment of the remoter organic effects of alcohol in the form of chronic inflammation of various organs, as neuritis, gastritis, hepatitis, and nephritis, does not come within the scope of this article, and will be found described under the appropriate divisions.

### Lead-poisoning.

The sources of lead-poisoning are very numerous. The most important part of the prophylaxis consists in discovering all of these sources possible, and avoiding them as far as can be done. The metal, however, is freely used in domestic construction, and its presence in the secretions in very small quantity has been frequently demonstrated in cases in which there have been no symptoms of its presence as usually recognized, so that one cannot always be sure of the relations between them. It is evident that there must be great differences in the individual susceptibility.

One of the most important sources, as being the most subtle and widespread, though far from being intense, is the ordinary water-supply through lead pipes. The prophylaxis here consists in the use of tin-lined or, much better, iron

pipes. The drinking of water from a lead-covered roof or a lead-lined tank seems so obviously dangerous that one would suppose, in the absence of direct proof to the contrary, that intelligent persons were hardly liable to poisoning from such a source. When water from lead pipes cannot be avoided, that which is first drawn after standing for some time should never be used. The only way to determine with certainty whether or not the water used is contaminated with lead is by actual analysis.

There are, however, occupations in which the danger is fully recognized, though only partially avoidable. Those who handle metallic lead or its alloys, like plumbers and typesetters, are in little or no danger if strict cleanliness be observed, as sufficient absorption of the metal from the palms of the hands does not take place to have any appreciable effect. The true point of entry is the mouth, to which dust is carried by the hands. Even in the case of house-painters the poisoning is not inevitable, although the risk is greater. The prophylaxis is the same, although it is probable that in this case the absorption through the skin is a factor of more importance, on account of the oily vehicle making the metallic salts more penetrating and more difficult to wash off.

In certain manufactures, however, in which the dust of lead-salts, such as the carbonate (white lead) or the oxid (litharge and red lead), fills the air, the risk of poisoning is at its maximum. This condition may be found in manufactories of lead paint, in glass-works, and in some kinds of rubber-factories. Here an important part of the prophylaxis is in the hands of the owners, in the form of thorough and specially adapted ventilation. The operative can to a certain extent protect himself by the use of respirators. The dust is probably absorbed from the mucous surfaces of the upper air-passages and of the mouth and stomach. Sulphuric-acid lemonade has been employed in such establishments with a view to rendering insoluble such portions of the dust as it may come in contact with in the digestive passages. The deficiencies of the plan are three: (1) There are very few metallic salts, even sulphates, that are absolutely insoluble in the fluids of the body; (2) the acid does not reach the dust that enters the air-passages; (3) it is very difficult to get operatives to use it for any length of time. Another prophylactic that is open to no objections, though it is difficult to see how it can be efficient, is the free use of milk. It probably acts partly mechanically and partly chemically to remove a portion of the poison from absorption.

Acute poisoning by lead is rare, and is usually the result of the drinking, by accident or by design, of some medicinal preparation, such as a solution of the acetate. It is a form of irritant poisoning, and is to be treated by the administration of a sulphate, such as that of sodium (Glauber's salt) or of magnesium (Epsom salt), which has the further advantage of being a cathartic. A sulphid might also be used, but it would have no special advantage and is much less likely to be at hand. The usual protectives and demulcents, such as milk and eggs, are also employed. From a strictly chemic point of view it might be an additional advantage if the latter were not so fresh as is usually considered desirable, as the hydrogen sulphid would act as a direct antidote.

The strictly medicinal use of lead acetate is rarely continued long enough to give rise to poisoning, though the possibility of such an accident should always be borne in mind.

The earliest symptom of chronic lead-poisoning is usually colic. The time-honored principles of treatment in this affection are not to be improved upon. They consist essentially in the use of an opiate and a vigorous but not too violent cathartic, with external warmth. If there is any reason to suppose that any lead remains unabsorbed in the intestinal canal, magnesium sulphate should be the cathartic chosen; otherwise the choice is wider, but in the great majority of cases either this or castor-oil will be as useful as any, and either of them may well be supplemented by copious hot enemata. The dose should be large enough to be promptly effectual. Opium should be given in any of the usual forms by the stomach, but more prompt relief may of course be obtained from morphin hypodermically. There is no objection to the simultaneous use of the two medicines, although it will sometimes happen that the relaxation of the spasm by the opiate will be sufficient to relieve the constipation. I recollect a patient, however, who had suffered much in former attacks of lead-colic, and who was sorely aggrieved, and somewhat contemptuous of youthful inexperience, because the opiate was administered before the cathartic, when his experience had convinced him that the inverse order was more effectual. The after-treatment, if any, should consist in careful regulation of the bowels, with iron for the usual anemia, and, of course, careful avoidance, so far as possible, of the original source of poisoning.

When the poison has penetrated more extensively, and has produced the more widespread changes in the nervous system constituting lead-paralysis, two things become desirable—to remove the metal as speedily and as safely as possible, and to restore the normal condition of the nerves and muscles. The first of these objects is accomplished by the use of the alkaline iodids. Lead iodid is not soluble in water, but is so in a solution of the alkaline iodids, although it is not certain in exactly what combination the metal exists either in the tissues or in the urine. The quantity is too small to admit of so delicate an analysis. Analyses have shown an increased renal elimination after the administration of the iodid. This procedure is often of value for diagnosis preparatory to treatment. It may safely be assumed, although this statement has been doubted, that if no lead be found in the urine after a few days' administration of the iodid, the patient no longer has lead in the body; and the drug cannot, of course, undo the effects of the poison. It is better to proceed cautiously, beginning with a small dose, say 30 centigrams (5 grains) or even less, and increasing gradually. Too large doses given at once are liable to induce an increase in the severity of the symptoms, especially the cerebral symptoms, by putting in circulation rapidly too large an amount of the metal, which was previously quiescent. There is no reason for doubt that all the soluble iodids would produce essentially the same effects, but as a matter of custom the potassic salt is usually employed. A convenient method of regulating the dose for this as for other purposes is to prescribe—

℞. Potassii iodidi, 25 gm. (ʒviss);
Aquæ, ad 100 gm. (fʒiij, ʒij).—M.
Sig. One cubic centimeter contains 0.25 gm. (gr. iv). Begin with 8 drops, to be taken in half a glass of water or milk, and to be increased as directed.

Rabuteau states that the bromids have the same solvent action as the iodids, and it might under some circumstances be desirable to use them as combining with their eliminative effect a sedative action upon the nervous system. The practitioner should, however, keep distinct in his mind, even if combined in the same prescription or the same drug, the two classes of action sought, as it may be desirable to advance the one or the other more rapidly.

A portion of lead is probably eliminated by the bowels, and, although any soluble salt would undoubtedly be rapidly reduced to an insoluble sulphid, it is desirable, in order to gain this advantage, as well as for other reasons, to guard against constipation. A small amount of lead has been supposed to be eliminated by the skin, and this elimination has been believed to be promoted by sulphur-baths. There is, however, no very good evidence of the latter assumption. Blackening of the skin would, it is true, be evidence of the presence of lead, but not of any increase over the previous amount.

In recent cases presenting wrist-drop, and when the renewal of the poison is promptly stopped, a certain amount of improvement may fairly be expected from the administration of iodids alone and from the progress of time. Soon, however, electric treatment becomes of value, and it should be persistently employed. So long as the muscles are responsive to the faradic current, this should be the one used, in strength sufficient to move the muscles distinctly, but not to the point of tetanus. When the faradic current is not capable of producing contractions, and the galvanic current is capable of doing so, the latter should be resorted to, applied in turn to the motor points of all the muscles affected. It is probable that in many or all forms of neuritis, nerve-regeneration is possible for a period that cannot be marked definitely, but which is somewhat extended. Hence the treatment should not be abandoned too soon. Careful massage in the form of deep kneading will be of great value. When some voluntary power is left, the weaker muscles, especially the extensors of the fingers, may be benefited by mechanical assistance in the form of elastic bands attached to a splint upon the back of the forearm, ordinary rubber bands being used, of sufficient strength not entirely to take the place of the enfeebled extensors, but to assist them. Passive movements and resistive movements will be of value in restoring tone. With these local measures should be combined others for the restoration of the general health, especially as regards dyspepsia, constipation, and anemia, which, however, demand no special mention beyond that which will be found under the appropriate headings and in what has already been said.

In the presence of the cerebral symptoms known, on account of the absence of all organic change except the presence of lead in the brain, by the name of "lead-encephalopathy," there are, with one exception, no special rules to be

laid down, but symptoms are to be treated as if arising from any other cause, for which directions will be found under the appropriate heads. The exception referred to is that the iodids and bromids should be used with great caution. It is probable that the poison which is responsible for the mischief is that which is circulating in the blood or which is just entering into new combinations with the tissues. These combinations, when accomplished, will leave the poison in a less actively harmful condition. Any increase in delirium or in the frequency of convulsions during the administration of these salts should be carefully looked for, and if found, the drugs should be withheld. The bromids in particular should be watched, as they may be given for the control of nervous excitability while the fact that they are liable to act as solvents of the metal is likely to be overlooked.

In the treatment of a case of lead-poisoning there should always be borne in mind certain pathologic affinities—that is, those between lead, uric acid, gout, and interstitial nephritis. Pure water is an excellent eliminant of nearly all poisons in combination with the normal constituents of the blood and urine, even though it is not a good solvent in the test-tube.

### Poisoning by Arsenic.

The susceptibility of different persons to the chronic action of arsenic varies immensely, and hence the prophylaxis must be much more strict in a certain set of cases than in the average. The slow and gradually increasing effect of arsenic arises usually from articles of domestic use, especially interior decorations, such as wall-paper, tinted ceilings, and sometimes dresses, paper boxes, etc. The looser the texture the greater the danger from the dust of the poison, but it is probable that the chemic changes in organic substances such as paste may set free gaseous compounds of the metal.

The greatly increased use of arsenical powders in agriculture constitutes a new source of danger unless care be taken that everything be washed thoroughly. The medicinal use of arsenic occasionally induces some of the slighter effects, although it is generally so carefully watched that no harm is done.

The prophylaxis consists in being aware of the danger and in searching for the poison in suspicious articles, and if necessary in the urine of the patient. It may be doubted, however, whether such a quantity as may give rise to minute traces in the urine should always be looked upon as causative of all the symptoms that may exist at a given time. The danger having been recognized and the patient having been removed from further deleterious influences, the symptoms on the part of the digestive organs are not likely to call for the usual chemic antidotes. The use for a few days of a bland and unirritating diet will usually be sufficient. If, however, protectives and sedatives should be called for, the use of bismuth should be avoided in case any further analysis of the urine is contemplated—not because this metal is likely to be contaminated by arsenic, as this danger is no longer a real one, but because its presence in the urine might embarrass the tests.

In regard to the other local irritations, those of the skin, the bronchi, the

tear-ducts, and the conjunctivæ, similar remarks may be made, as, beyond the avoidance of the cause, there is nothing special in their treatment. An arsenical neuritis, however, is a more serious matter, but it demands only the treatment that would be bestowed upon any neuritis—that is, chiefly rest, local or general, warmth, occasional counter-irritation, and later the use of electricity and massage.

### Poisoning by Mercury.

Constitutional poisoning by mercury is much less common than it used to be, and for several reasons. Medical views have changed as to the nature of the beneficial action of mercury, so that it is much less frequently pushed to its extreme therapeutic limits. Syphilis is treated more carefully, and other diseases call for the marked constitutional effects of mercury much less commonly now than formerly. Changes and improvements in many methods employed in the arts, especially in silvering and gilding, have greatly diminished the number of cases of accidental mercurial poisoning.

Stomatitis and salivation are to be avoided through a knowledge of the risk and avoidance of the vapor of the metal, and by cleanliness of the hands. No large surface should be exposed to the influence of strong solutions of mercuric chlorid, as in midwifery and surgery. The mouth is to be kept scrupulously clean, and astringents are to be used to harden the gums. Catechu, kino, rhatany, or oak-bark among the vegetables, and alum or astringent iron-salts, may be employed in this way. Potassium chlorate has been found useful, although its action is less easy to explain. Tincture of myrrh or tincture of guaiacum will make a useful addition to a mouth-wash. Atropin in the dose of 1 or 2 milligrams (gr. $\frac{1}{60}$ or gr. $\frac{1}{30}$) will assist in diminishing the secretion. While salivation is going on it is not desirable to increase the rapidity of elimination, but after it has ceased the iodids may be used for this purpose, bearing in mind constantly that it is not desirable to put in circulation at once too large a quantity of the metal. Renewal of salivation may take place under this treatment, and it is probable that most cases of salivation following the use of an iodid are of this compound character, although a few of a mild type are correctly attributable to the mercurial salt alone.

The anemia that is likely to be an important condition in any case of chronic mercurial poisoning should be anticipated or be met promptly by the use of a liberal diet together with iron.

Active diuresis by the use of a large quantity of pure water, or diaphoresis by hot-air baths, will hasten elimination, and by carrying away a portion of the poison through other channels will lessen the intensity of the salivation and the dangers of stirring up too large a quantity of the metal at a time.

Tremor and various morbid conditions, chiefly of a depressing character, may arise from mercurial poisoning. The treatment, however, except so far as has already been described, is adjusted to the symptoms rather than to the cause. If the poisoning has been recent, elimination should be favored and the nutrition be studiously promoted by means of diet, tonics, and exercise.

# SEPTICEMIA AND PYEMIA.

By JOHN CHALMERS DaCOSTA.

## Septicemia.

Septicemia is a condition of systemic intoxication due to the absorption of poisonous material from a focus of infection. One form of the disorder is caused by the absorption of poisonous alkaloids (toxins) in large amount, no organisms entering the blood, and is known as "sapremia"—putrid or septic intoxication. Sapremia is most frequently encountered after labor, or phlegmonous erysipelas, or the performance of a major amputation, or a compound fracture, or the infection of a huge psoas-abscess; that is to say, it is most common when a large mass of clot or exudate under pressure becomes putrid.

Another form of the disorder is due to the absorption of organisms as well as toxins, and is known as "septic infection"—true or progressive septicemia. Septic infection is as common after small wounds as after large wounds, and is especially to be dreaded after punctures. In sapremia, if a little blood drawn from the sufferer is injected into an animal, the disease is not reproduced. In septic infection, if the same experiment be tried, the disease will be reproduced in an aggravated form. Septic intoxication is comparable to a condition of poisoning by a vegetable alkaloid; being a state of poisoning by animal alkaloids, the intensity of the symptoms and the degree of danger depending upon the dose. Progressive septicemia is a true infective process, and an originally small number of organisms, after absorption, multiply enormously in the blood and the tissues. In sapremia drainage and disinfection of the area of infection prevent the absorption of more poison, but in true septicemia drainage and disinfection of the original area of infection leave untouched countless other reservoirs capable of pouring their poison into the system. Clinically it is often impossible to sharply differentiate between these two forms, and in man they frequently occur in combination.

The primary seat of infection is usually a wound, which is likely to be without granulations, though not of necessity so. Billroth taught that healthy granulations are completely protective, but Maas and Hack have proved that they are not (Tillmanns). Any wound may be responsible for septicemia, but punctured wounds and lacerated wounds are particularly dangerous. Traumatism with unbroken skin may in rare instances be followed by septicemia. I have seen a case in which, after breaking up adhesions in the knee-joint, suppuration ensued and the patient perished of

septicemia. The injured surface is a point of least resistance, and readily takes up organisms from the blood, while its lessened tissue-resistance permits their rapid multiplication.

Septicemia may be due to abscess, superficial or deep-seated (mastoid, hepatic, mediastinal, etc.), meningitis, childbirth, gangrene, cellulitis or phlegmonous erysipelas, malignant edema, absorption from the genito-urinary tract as in septic cystitis and urethral fever, compound fractures, acute epiphysitis or osteomyelitis, suppuration of the sac of an aneurism, septic peritonitis, absorption from the gastro-intestinal tract as in tyrotoxicon-poisoning, absorption from the lungs, ulcerative endocarditis, and numerous other conditions. If the source of the poison cannot be found, the condition is designated "cryptogenetic septicemia."

The causative organisms are cocci or bacilli, but in true septicemia pus-cocci are most frequently the etiologic factors. Among the causative organisms may be mentioned the pneumococcus, the bacterium coli commune, the streptococcus septicus, the streptococcus pyogenes, and the staphylococcus pyogenes aureus and citreus.

Septicemia was so common before the discoveries of Pasteur and the practical labors of Lister that operations were undertaken with a conviction upon the part of the surgeon that the fate of the patient was to be determined by some inscrutable, unavoidable, and often malignant destiny, and that luck was the determining factor. The celebrated Pirogoff wrote an essay upon "Luck in Surgery." We now know that septicemia arising after an operation is due to micro-organisms and not to chance. We know that in the great majority of cases these organisms enter from without, having been present upon the skin of the patient, the hands of the surgeon or of his assistants, or the instruments or dressings employed. To exclude organisms from without is to prevent septicemia after operations, except in very rare cases, such as that of ankylosis of the knee already cited, and we seek to attain such an end by the aseptic method, and to destroy the organisms present by antiseptic procedures.

Every operation, however trivial or however severe, from the administration of a hypodermic injection to an amputation of a limb, and every accident, however slight or however grave, from a splinter in the finger to a crush of an extremity, opens a gateway for the entrance of organisms and favors infection by lowering the vital resistance of the tissues. Every accidental wound must be regarded as a surgically dirty wound, and must be cleansed and dressed with scrupulous care. Every operation must be conducted according to the most rigid methods of modern science. A consideration of aseptic and antiseptic technic belongs to the domain of surgery, and not to a work of this character.

Is there such a thing as immunity to septicemia? If the antidotal action of the tetanus-antitoxin and the diphtheria-antitoxin are facts, a broader application of the theory might be permitted to suppuration. If an animal can be rendered immune to tetanus by the injection of attenuated cultures of tetanus-bacilli, why cannot an animal be rendered immune to suppuration by

injection with attenuated cultures of pus-organisms? Either artificial immunity to tetanus expresses a great natural law which must apply to all organisms, pus-cocci as well as others, or else it expresses an almost isolated tendency, true of but a limited number of organisms. The more isolated the tendency the more questionable is its truth. Charrin[1] claims that rabbits inoculated with attenuated cultures of the bacillus pyocyaneus are rendered immune to the disease that this bacillus tends to produce. Reichert states that he conferred a similar immunity upon dogs and rabbits by inoculating them with cultures of staphylococci (Schimmelbusch). Clinical experience shows absolutely that recovery from suppuration does not in any degree protect from subsequent suppuration. There seems to be no such thing as immunity, natural or acquired, to suppuration or septicemia.

**Treatment.**—In every case of septicemia the cause should be sought for and the primary depot of infection be found. The rules for treatment are to drain and asepticize the area of infection, in order to limit the introduction of more poison, to favor elimination of the poison, and to sustain the patient.

In septicemia from wounds, these should be laid widely open, scraped with a sharp spoon, irrigated with hydrogen dioxid and with a solution of mercuric chlorid (1 : 1000), in some instances cauterized with pure carbolic acid, dusted with iodoform, drainage secured by the introduction of tubes or by packing with iodoform-gauze, and a dressing of dry mercuric-chlorid gauze applied, unless sloughing occurs, when antiseptic fomentations are desirable. The dressings should be changed frequently, to permit of irrigation.

A punctured wound is laid open with a knife to its depths, is scraped, cauterized with pure carbolic acid, and packed with iodoform-gauze.

Red and swollen lymphatic vessels and glands are treated by painting the skin with iodin and applying ichthyol over the dried coat of iodin. A wounded extremity should be immobilized, to secure rest. If glands suppurate, they should be incised and asepticized. Cellulitis and phlegmonous erysipelas demand multiple incisions. Catheter-fever requires the introduction and retention of a soft catheter and washing out of the bladder. Septic cystitis calls for washing out of the bladder in mild cases, perineal section or suprapubic cystotomy in grave cases. In compound fractures the wound is to be asepticized, a counter-opening is to be made for drainage, and the wound is to be dressed and immobilized. In osteomyelitis the bone should be trephined. A collection of pus, *no matter where* (in liver, brain, mastoid, or kidney), must be evacuated and the cavity be asepticized and drained. In septic peritonitis the best chance for recovery is afforded by celiotomy, irrigation with gallons of hot normal salt-solution, and the introduction of a glass tube. If, twenty-four hours after labor, the temperature remains above 100° F. (37.8° C.) without an obvious cause, the uterus should be irrigated by means of an intra-uterine catheter with about a quart of a hot solution of mercuric chlorid (1 : 2000). If, after another twenty-four hours, the temperature has not fallen, all infected matter should be removed

[1] Charrin and Roger: *Comptes rendus de la Soc. de Biol.*, 9me. sér., T. 1, 1889.

from the interior of the uterus by means of a curet and placental forceps and the uterus be irrigated again.

The *constitutional treatment* is purely symptomatic. Stimulants must be given in very large amounts. Whisky and brandy are to be preferred if the stomach tolerates them. Champagne may be employed. Whisky is given until it strengthens the first sound of the heart. If the patient becomes flushed, smells strongly of alcohol, or shows greatly increased delirium, the dose should be limited.

Liquid and easily digested food is given at frequent intervals. Milk, koumiss, and beef-peptonoids are valuable.

Billroth advised that the skin be kept active, to favor the elimination of the poison. This aim can be secured by hot baths, hot drinks, wrapping the patient in hot blankets, or the hypodermic use of pilocarpin.

The kidneys should be stimulated by Poland water, digitalis, and hot poultices over the back. Digitalis is further of value as a heart-tonic. Strychnin and atropin may be administered from time to time.

For septic diarrhea opium is given, combined with tannic acid, bismuth, or lead acetate. An enema of starch and laudanum is often temporarily beneficial. Quinin is given in tonic rather than in antipyretic doses. Warren says that antipyretics are unsatisfactory in septicemia, though in mild forms of the disorder these remedies may be productive of great relief to sleepless subjects.

Sleep is secured through phenacetin, antipyrin, sulfonal, trional, or chloral.

## Pyemia.

Pyemia is septicemia plus metastatic abscesses. The condition is produced by the same organisms, is found under the same circumstances, and is guarded against and treated exactly as is septicemia, with the additional necessity of opening metastatic abscesses when recognized in accessible situations.

# ERYSIPELAS.

By JOHN CHALMERS DaCOSTA.

THAT erysipelas is caused by a micro-organism is now universally admitted, and most observers think that this organism is identical with the streptococcus pyogenes. The organism is not capable of affecting the sound skin or mucous membrane, but effects an entrance by means of a breach in continuity either through an extensive wound obvious to the most casual observation, or through a scratch or a puncture so minute as to escape recognition after the most careful search. This view was long ago maintained by Trousseau.

Erysipelas is first a local infection, while the constitutional symptoms so frequently present are due to absorption of the toxic products of bacterial growth. This view of the nature of erysipelas is strengthened by many facts. Thus, the streptococcus is not found in the blood, and this fluid will not infect animals if injected. In many cases a breach in continuity is discovered, but even if such a breach cannot be found, lymphatic involvement or other evidence of local disorder will be observed. As erysipelas is primarily a local infection, it is obvious that its prevention after operations and in wound-treatment depends largely upon rigid asepsis. Furthermore, as the poison of erysipelas can be transmitted by the dust-laden air, an infected case should be isolated, to prevent the infection of others. The germ is readily destroyed when treated with antiseptics. A 1 : 30 carbolic-acid solution is capable of destroying the streptococcus in less than a minute, and a 1 : 1000 solution of mercuric chlorid is fatal to it in fifteen seconds. In spite of the apparent ease of disinfection, it must be regarded as improper for a physician who is attending a case of erysipelas to also attend a woman in confinement.

Erysipelas may attack the skin (simple cutaneous erysipelas), the vulva, the mucous membrane of the pharynx and larynx, the navel or genitalia of a newborn child (erysipelas neonatorum), the cellular tissue (diffuse cellulitis), and both the skin and cellular tissues (phlegmonous erysipelas).

**Simple cutaneous erysipelas** requires both constitutional and local treatment.

*Constitutional Treatment.*—In the beginning of a case a purgative dose of calomel or of Epsom salt should be given, but the purging is not to be continued after the bowels have once been well moved. The diet is to be liquid and highly nutritious, and food is to be given at short intervals. The foods usually employed are milk, eggs, beef-peptonoids, meat-juice, broths, clam-juice, etc. Strong coffee is of service in this depressing disease. All severe cases call for alcoholic stimulation, the indications being a weak pulse and

enfeeblement of the first sound of the heart. The dose is regulated according to the strength and tension of the pulse. If delirium increases, the dose should be reduced. To hard drinkers alcohol must always be given, as to withhold it results in inability to sleep and to take food. Whisky, brandy, or champagne may be used. If the patient sleeps badly, potassium bromid, sulfonal, paraldehyd, hyoscin, or chloral may be given, the fact being borne in mind that chloral and hyoscin are dangerous if the heart is weak, and that paraldehyd is so likely to nauseate that it had best be given as an enema.

Among the drugs used in the treatment of erysipelas, pilocarpin, first used by Dr. J. M. DaCosta, holds a high place. It is entirely useless in advanced cases, and should not be used if debility is pronounced. It is suited to beginning attacks, and the object is to induce profuse sweating. The dose is from gr. $\frac{1}{8}$ to gr. $\frac{1}{6}$ (0.0081–0.011) by hypodermic injection. The injection should not be made at the edge of the inflammatory area, as the drug is not antiseptic, and the puncture made by the needle may facilitate the entrance of cocci into the deeper tissues, where they may set up phlegmonous erysipelas.

Aconite is used by some physicians. It is suited only for recent cases in which the temperature is rising, and it must never be given to drunkards, to the very young or the very old, when debility is marked, or late in a case. Aconite is given in doses of $\frac{1}{2}$ minim (0.031) every half-hour, until the heart slows, the pulse softens, the temperature falls, and sweating is induced, when the intervals between the doses must be lengthened. Veratrum viride is often preferred to aconite.

Tincture of belladonna is suited to advanced cases, especially if dyspnea exists, 4 or 5 minims (0.25–0.31) being given every four hours. Tincture of ferric chlorid is warmly praised by Reynolds, and is undoubtedly of decided value. It is to be used in advanced cases or when pilocarpin has failed. From 30 to 40 minims (2. to 2.5) may be given every four hours. It is well to conjoin with this drug the daily administration of from 12 to 15 grains (0.78–1.) of quinin.

High temperature calls for cold sponging or perhaps for the guarded use of phenacetin, acetanilid, or antipyrin. During convalescence the patient must be well nourished. Tonics will be required, together with malt liquors, red wine, sherry, or port.

*Local Treatment.*—The seat of primary infection should always be sought for. If an abrasion exists, it should be antisepticized thoroughly, dusted with iodoform, and dressed with mercuric-chlorid gauze. One of the most useful methods of treatment is to paint daily the erysipelatous area and the sound skin adjacent with tincture of iodin diluted with an equal bulk of alcohol, two or three coats being applied by means of a brush or a sponge. The part is then covered with lint soaked with lead-water and laudanum and constantly moistened afresh, and if we are dealing with an extremity a bandage is applied. The iodin is antiseptic and sorbefacient; the mixture of lead-water and laudanum is anodyne and astringent; evaporation produces cold; and the bandage exercises compression.

Many surgeons rely locally on germicides. Hayem uses equal parts of alcohol and crystallized carbolic acid painted around the edges of the inflammatory area and upon the healthy and diseased skin adjacent. J. C. White applies at alternate hours an evaporating lotion of carbolic acid (ʒss—2.) in alcohol and water (each fʒiv—120.). Kraske cleanses the parts with soap and water and mercuric-chlorid solution, makes multiple punctures into the edges of the inflamed skin and about its margins, permits serum and blood to flow for a time, applies compresses soaked in a 2 per cent. solution of carbolic acid, and changes them twice a day. Hueter injects carbolic acid (1 : 30) around the zone of erysipelas if that zone is small enough to be surrounded by four or five punctures (Marcus Beck). My own experience with carbolic-acid injections is disappointing, and I further believe that external applications of sufficient strength to impress the disease are too profoundly irritant to be employed continuously, and only the continuous use is curative.

Riedel,[1] after making many radiating incisions through the margin of the redness, each incision being so superficial as to draw very little blood, applies compresses wet with a solution of mercuric chlorid, 1 : 1000, and renews them three times a day.

A paste of creosote and kaolin is used by Marshall; equal parts of glycerin and sulphurous acid by Dewar; a 10 per cent. solution of aristol by Ferrand. Some surgeons employ injections of boric acid, and others a spray of the ethereal solution of mercuric chlorid. It is to be remembered that the last-named preparation may produce pigmentation. Koch[2] of Vienna applies upon and around the area of erysipelas an ointment containing 1 part of creolin, 4 parts of iodoform, and 10 parts of lanolin, and covers the application with gutta-percha paper. Churiloff[3] uses 1 and 2 per cent. ointments of parachlorphenol and orthobromphenol rubbed in twice a day for one minute each time. Of 20 cases treated by this method, Churiloff cured 19 in from three to six days. The application causes some smarting and induces a fall of temperature, but it produces no ill effects. The local use of guaiacol is a promising plan of treatment.

Von Nussbaum's method is certainly efficient, finds many advocates, and has been modified in various ways. I apply it as follows: The part is washed with ethereal soap and hot water and douched with hot mercuric-chlorid solution (1 : 1000); it is then dried with an aseptic towel, and over it is spread an ointment consisting of equal parts of ichthyol and lanolin. The dressing is completed with antiseptic gauze, and a bandage if we are dealing with an extremity. Ringer treated erysipelas with topical applications every three hours of a mixture composed of tannic acid gr. xxx (2.), camphor gr. xxx (2.), and ether fʒiv (16.).

Peripheral compression has been advised to check spreading of the inflammatory process. Wölfler[4] straps the part with pieces of plaster. Renay applies a mixture of equal parts of ichthyol and an alcoholic solution of gutta-

[1] *Deutsche med. Wochenschrift*, Nov. 11, 1889.
[2] *Therapeutische Monatshefte*, Sept., 1889.
[3] *Lancet*, May, 1893.
[4] *Wiener klin. Wochenschr.*, June 6, 1889.

percha. The attempt to stop the spread of the disease by circumscribing the inflammatory area by a line drawn with lunar caustic always fails. Silver nitrate (20 grs.—1.3—to ʒj—4.) is applied over the erysipelatous blush by Higginbottom. Valette advises that a 30 per cent. solution of ferric chlorid be rubbed into the inflammatory area by means of a gloved hand. Extract of belladonna with an equal part of glycerin makes an agreeable and soothing application, especially if adenitis is marked.

Unna applies a mixture containing ʒj (4.) each of ether and ichthyol and ʒij (8.) of flexible collodion.

Among the numerous other plans may be mentioned the injection at the edge of the blush of gr. $\frac{1}{16}$ (0.0041) of mercuric chlorid; the application of lead-paint, of carbolized zinc-ointment, or of equal parts of zinc-ointment, resorcin, and ichthyol; the use of hot fomentations, iced compresses, or iced poultices; wrapping up the part in cotton-wool; hot poultices; painting with pure tar; the application of plain collodion or of iodoform-collodion; the use of oil; and the employment of such powders as borated talcum, zinc oxid, starch, and flour.

The best plan in my experience is the use of iodin, lead-water and laudanum, and compression, and the next best plan is the employment of ichthyol after the method of Von Nussbaum.

**Erysipelas of the Vulva.**—This disorder, which is not unusual in young children, requires the asepticizing of any abraded surface, the administration of iron by the stomach, and the local use of iodin diluted with 2 parts of alcohol and followed by lead-water and laudanum or ichthyol in a strength of 20 per cent.

**Erysipelas of the Pharynx.**—Tincture of ferric chlorid is given internally, and if depression is not marked it may be combined with aconite. The iron is not only valuable for its constitutional influence, but when swallowed is brought in contact with the local inflammation. Bedford Brown advises strong counter-irritation of the neck and chest to induce migration of the disease, and Sajous recommends for the same purpose counter-irritation over the liver.

The local use of a 10 per cent. solution of cocain relieves the pain.

**Erysipelas of the Larynx.**—In this most dangerous disease the onset of edema of the larynx, edema of the lungs, and other complications should be watched for. From the outset stimulation should be resorted to by means of alcohol, strychnin, caffein, or digitalis. Digitalis should invariably be used to maintain the activity of the kidneys, to strengthen the heart, and to combat the tendency to pulmonary edema. Ferric chlorid is always given. Sajous recommends the application of a 25 per cent. solution of cocain to combat laryngeal edema. Mustard-plasters to the throat may do good. If the edema increases, scarification should be practised, and if this fails intubation (which is difficult in these cases) or tracheotomy should be performed.

**Phlegmonous Erysipelas.**—Any wound or area of infection should at once be drained and asepticized. The inflamed area and the adjacent parts should be painted with tincture of iodin, and over this lead-water and laud-

anum, mercurial ointment, ichthyol, or hot fomentations applied. If an extremity is affected, a roller bandage and a sling should be employed. Internally are to be given iron and quinin, a nourishing diet, and powerful stimulation; the bowels are to be opened by means of calomel or a saline. If suppuration occurs, or, better, before it occurs when it appears to be inevitable, multiple incisions should be made. The wounds are to be sprayed out with hydrogen dioxid, irrigated with mercuric-chlorid solution (1 : 1000), and strips of iodoform-gauze tucked into the incisions are to be employed for drainage. Any area of gangrene is to be excised. The dressing is to be completed with gauze wet with a solution of mercuric chlorid, and this is covered with rubber dam. Upon the dressing is placed a hot-water bag. If sloughs form, they are to be snipped away and antiseptic fomentations are to be continued. When granulations begin to form, the treatment should be that of any healing wound.

**Cellulitis.**—Any wound or abrasion should be drained and antisepticized, the part painted with iodin, and the treatment conducted as in the condition last considered. Internally, iron, quinin, stimulants, and a nourishing diet should be given. If pus forms, the treatment should be that of phlegmonous erysipelas.

# DIPHTHERIA.

By W. P. NORTHRUP.

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There are two forms of pseudo-membranous sore throat of bacterial origin—that caused by the Klebs-Loeffler bacillus, and that caused by streptococci. In the latter form the prognosis is favorable except when complicating scarlatina or true diphtheria.

By diphtheria we mean properly only the disease caused by the virulent Klebs-Loeffler bacillus. Its characteristic local lesion is a pseudo-membranous or necrotic inflammation of a mucous membrane, or sometimes of a denuded skin-surface or a wound. The most common seat of this process is in the pharynx and nares; it often occurs in the larynx, trachea, or bronchi, and occasionally is found upon the vulva or the skin. Beginning as a local lesion, there follows a systemic poisoning widely differing in degree in different cases. The systemic poisoning of diphtheria is due to a soluble poison elaborated at the seat of lesion by the bacillus diphtheriæ and absorbed into the general system.

There is, besides, in most cases a third element, of great importance from a therapeutic standpoint—an added infection due to the various organisms that may find in the local inflammatory lesion suitable conditions for growth. Other bacteria besides the bacillus diphtheriæ give rise to necrotic inflammation, which under these circumstances has been called "pseudo-diphtheria." Streptococci, either alone or associated with other pus-forming cocci, are capable of causing upon mucous membranes a pseudo-membranous inflammation in no way distinguishable morphologically from the pseudo-membrane of true diphtheria. Diphtheria that escapes the complications to which it is exposed by these commonly present pus-forming cocci, the streptococci, may be called pure diphtheria. The complicated form has been called "mixed" or concurrent infection. When the conditions become favorable the streptococci may penetrate the tissues beneath the pseudo-membrane, enter the lymphatics, and advance to the lymph-nodes (glands) of the neck, and the disease may take on new features. In addition to the specific poison absorbed from the lesion caused by the bacillus diphtheriæ, there may be a suppurative inflammation, going on to abscess. The cocci may gain wide access to the body, to the serous cavities, as well as to the mucous membranes. We may then find ourselves face to face with abscesses in various parts of the body, empyema, arthritis, endocarditis, pericarditis, suppurative inflammations, and, lastly, that most frequent complication of all, broncho-pneumonia.

**Prophylaxis.**—In considering prophylaxis we must call to mind several facts. There can be no true diphtheria without the presence of the bacillus diphtheriæ, and in some manner this must be transmitted from some previous case. All the secretions from the mouth and nose of the patient may contain bacilli, which in a dried form, distributed upon fabrics, books, toys, or about the room, retain their virulence for months, and thereafter, under favorable conditions, infect susceptible throats. For days, and not infrequently for weeks, after the pseudo-membrane caused by the bacillus diphtheriæ has disappeared from the throats of diphtheria-patients, cultivation has proved the survival of the germ, and in a condition to infect new cases.

Diphtheria is essentially a disease of childhood, the number of cases increasing from the first up to the fourth year of life, when it occurs most frequently, and thereafter gradually decreasing.

It is now known that the bacillus diphtheriæ is frequently found in the healthy throats of persons much exposed to the contagium, such as those of other members of the family in which patients are suffering from the malady. It is also known that inflammation of the throat without false membrane, possibly so-called "sympathetic sore throat," may be a result of the action of the bacillus diphtheriæ in persons exposed to diphtheria, but otherwise apparently healthy. Thus, both well persons and those suffering from a non-pseudo-membranous sore throat are frequently the means of transmitting diphtheria. Still, it is often impossible to account for the transmission of the Klebs-Loeffler bacillus in cases in which most careful and intelligent directions have been given and, presumably, carried out. One thing remains clear, that there is no true primary diphtheria without the Klebs-Loeffler bacillus, whether we are able to settle the question as to its mode of transportation or not. A careless attendant on an evening visit to a neighbor transports it more often than do the breezes. An illustrative instance may be cited:

A suspicious nasal discharge was discovered in a case in the children's ward of the Presbyterian Hospital. The child was at once isolated, cultures were made, and virulent bacilli were found. Cultures were then made from all the throats in the ward. None of these contained Klebs-Loeffler bacilli, and the ward went on as usual without subsequent cases. It was found on investigation that an assistant nurse in that ward, who had been on duty temporarily, had similar bacilli in her throat, though not in the least sick herself. These two cases had been in contact, and it was believed that one infected the other. The nurse at no time felt sick, and no pseudo-membrane was seen in her throat.

Knowledge of occurrences like this is necessary to an intelligent prophylaxis. In New York, where diphtheria in a severe form is endemic, and frequently epidemic, the Board of Health has met a great call of humanity in devising practical methods of early detection of the germ in suspected cases, and, further, has furnished the medical profession with facilities for having the nature of cases determined by culture-tests, without expense or personal trouble. It may be said that for intelligent prophylaxis culture-tests of suspected throats have become a necessity. Without them the disease can never

be kept from spreading in a community. Where these facilities are not present, a quarantine of four weeks is the least that can be considered safe.

*Personal Prophylaxis.*—What can be done for persons necessarily brought in contact with the diphtheria-patient, confined to the limits of a flat or a tenement? Our answer to this question would be the cleansing of the throat and nose with bland fluids—warm salt and water, a teaspoonful to a pint, or a warm saturated solution of boric acid, used either as a gargle or as a douche. Among the persons in contact with a diphtheria-patient a few will prove susceptible. On the rising tide of improved nutrition it is believed many of the dangers of susceptibility may disappear. Outdoor exercise, when practicable, is to be recommended. Besides improving the appetite and the powers of assimilation, cold fresh air tends to self-cleansing of the naso-pharynx by stimulating the flow of mucus.

The Health Department of New York City has issued the following admirable regulations in cases of contagious diseases; the portion pertaining to diphtheria is quoted verbatim:

*Directions to Prevent other Cases of Diphtheria occurring in a Family in which one Case exists.*

1. If possible, one attendant should take the entire care of the sick person, and no one else, besides the physician, should be allowed to enter the sick-room. The attendant should have no communication with the rest of the family. The members of the family should not receive or make visits during the illness.

2. The discharges from the nose and mouth must be received on handkerchiefs or cloths, which should be at once immersed in a carbolic solution (made by dissolving 6 ounces of pure carbolic acid in one gallon of hot water, which may be diluted with an equal quantity of water). All handkerchiefs, cloths, towels, napkins, bed-linen, personal clothing, night-clothes, etc. that have come in contact in any way with the sick person should after use be immediately immersed, without removal from the room, in the solution named. These should be soaked for two or three hours, and then boiled in water or soap-suds for one hour.

3. In diphtheria and scarlet fever great care should be taken, in making applications to the throat or nose, that the discharges from them are not in the act of coughing thrown into the face or on the clothing of the person making the applications, as in this way the disease is likely to be acquired.

4. The hands of the attendant should always be thoroughly disinfected by washing in the carbolic solution, and then in soap-suds, after making applications to the throat or nose, and before eating.

5. Surfaces of any kind soiled by the discharges should be immediately flooded with the carbolic solution.

6. Plates, cups, glasses, knives, forks, spoons, etc. used by the sick person for eating and drinking must be kept for his especial use, and under no circumstances be removed from the room or mixed with similar utensils used by others, but must be washed in the room in the carbolic solution and then in hot soap-suds. After use the soap-suds should be thrown in the water-closet, and the vessel that contained it should be washed in the carbolic solution.

7. The room occupied by the sick person should be thoroughly aired several times daily, and swept frequently, after scattering wet newspapers, saw-dust, or tea-leaves on the floor to prevent the dust from rising. After sweeping, the dust upon the wood-work and furniture should be removed with damp cloths. The sweepings should be burned

and the cloths be soaked in the carbolic solution. In cold weather the sick person should be protected from drafts of air by a sheet or a blanket thrown over his head while the room is being aired.

8. When the contagious nature of the disease is recognized within a short time after the beginning of the illness, . . . . it is advised that all articles of furniture not necessary for immediate use in the care of the sick person, especially upholstered furniture, carpets, and curtains, should be removed from the sick-room. . . . .

9. When the patient has recovered from any one of these diseases, the entire body should be bathed and the hair be washed with hot soap-suds, and the patient should be dressed in clean clothes (which have not been in the room during the sickness) and removed from the room. . . . . Under no conditions should it be again entered or occupied until it has been thoroughly disinfected. Nothing used in the room during the sickness should be removed until after this has been done.

10. The attendant and any one who has assisted in caring for the sick person should also take a bath, wash the hair, and put on clean clothes before mingling with the family or other people after the recovery of the patient. The clothes worn in the sick-room should be left there, to be disinfected with the room and its contents.

## *Disinfectants and Methods of Disinfection recommended by the Health Department of the City of New York.*

*Agents for Cleansing and Disinfection.*—Too much emphasis cannot be placed upon the importance of sunlight, fresh air, and cleanliness, both as regards the person and the dwelling, in preserving health and protecting the body from all kinds of disease. Sunlight and fresh air should be freely admitted through open windows, and personal cleanliness should be attained by frequently washing the hands and body.

Cleanliness in dwellings, and in all places where men go, may under ordinary circumstances be well maintained by the use of the two following solutions:

(1) *Soap-suds Solution.*—For simple cleansing, or for cleansing after the methods of disinfection by chemicals described later, 1 ounce of common soda should be added to 12 quarts of hot soap (soft soap) and water.

(2) *Strong Soda-solution.*—This, which is a stronger and more effective cleansing solution, is made by dissolving ½ pound of common soda in 3 gallons of hot water. The solution thus obtained should be applied by scrubbing with a hard brush.

When it becomes necessary to arrest putrefaction or to prevent the spread of contagious diseases by killing the living germs that cause them, more powerful agents must be employed than those required for simple cleanliness, and these are called disinfectants. The following are some of the most reliable disinfectants:

(3) *Heat.*—Complete destruction by fire is the best method of disposing of infected articles of small value, but continued high temperatures not as great as that of fire will destroy all forms of life; thus, boiling or steaming in closed vessels for one-half hour will destroy all disease-germs.

(4) *Dry Chlorinated Lime.*—This must be fresh and be kept in closed vessels or packages. It should have the strong pungent odor of chlorin.

The proprietary disinfectants which are so often widely advertised and whose composition is kept secret are relatively expensive, and often unreliable and inefficient. It is important to remember that substances that destroy or disguise bad odors are not necessarily disinfectants.[1]

[1] The cost of the carbolic solution is much greater than that of the other solutions, but generally it is much to be preferred. When the cost is an important element the mercuric-chlorid solution may be substituted for all purposes for which the carbolic solution is recommended, except for the disinfection of discharges, eating-utensils and articles made of metal, and of clothing, bedding, etc., which are very much soiled. Its poisonous character, except for external use, must be kept constantly in mind.

*Closets, Kitchen and Hall-way Sinks, etc.*—Each time the closet is used for infected discharges, a pint of the carbolic solution should be poured into the pan (after it is emptied) and allowed to remain there. All discharges should be disinfected before being thrown into the closet. Sinks should be flushed at least once daily.

*In case of death* the body should be completely wrapped in several thicknesses of cloth wrung out of the carbolic or mercuric-chlorid solution and placed in an hermetically sealed coffin.

It is important to remember that *an abundance of fresh air, sunlight, and absolute cleanliness* not only help to protect the attendants from infection, but also aid in the recovery of the sick.

In disinfecting a room after the release of the diphtheria-patient it is my practice to have the wood-work thoroughly scrubbed with hot water and strong soap. The wood-work includes bedstead, bureau, chairs, and everything else that will not be entirely ruined by the scrubbing. Thereafter these same parts are thoroughly wet with corrosive-sublimate solution, in a strength varying from 1 part of mercuric chlorid to from 2000 to 500 parts of water. This solution must be applied by means of a swab or a mop, not the bare hand, on account of its irritating properties. As to the floor, it should be nearly flowing with corrosive-sublimate solution, otherwise the dust and lint entangling the germs will not be thoroughly soaked. All wall-papers should be stripped off and all decorations that cannot be soaped and soaked, and also the ceiling, must be wiped down with clean, soft cloths such as cheesecloth, and then be wiped with bread-crumbs. Fabrics must be boiled or burned. Pillows and mattresses should be subjected to steam at 212° F. (37° C.), and when this is not possible they may wisely be sacrificed. After all cleaning and disinfecting it is well to let the room stand freely open for fresh air and sunlight; and, finally, it is very important to paint, paper, and calsomine the room.

**Treatment.**—In considering the treatment of diphtheria we must have regard to the local lesion, to the systemic intoxication, and to the complications.

*Local Treatment.*—When the specific germ of diphtheria in virulent form lodges in the pharynx of a person for any reason susceptible—that is, finds a favorable soil—it begins its growth. It multiplies and grows, and in so doing develops a soluble poison. It no doubt finds lodgement in all parts of the fauces, but commonly the conditions are more favorable for its growth upon the tonsils. This may be because the crypts furnish a protected nest, or because their contents contain a material that may furnish a favorable culture-medium having suitable reactions. An anatomic reason for the tonsils being the favorite point of first attack is that their protecting epithelium is the thinnest. Recent studies of Hodenpyl upon this subject show that rarefication of epithelium often leaves parts of the tonsils covered with a single protective layer of cells. The slightest trauma upon so thin a covering might easily expose the subepithelial tissue, and we should have the very elective conditions for inoculation—indeed, the conditions sought in producing experimental diphtheria in animals. It is upon the tonsils, then, that we should expect to find, and generally do find, the first evidences that the Klebs-Loeffler bacillus has begun its work. Having

found lodgement and begun its growth, it first causes superficial circumscribed death of a part (necrosis). The secondary effect on the tonsil is an inflammation of the adjacent parts. The products of inflammation, serous effusion, etc. form with the necrotic material an appreciable mass. The cells lose their nuclei, their outlines become indistinct, and their bodies become shiny and translucent. The pseudo-membrane then is made up of necrotic tissue and the degenerated products of inflammation. This is purely an anatomic lesion. Within this pseudo-membrane are germs, the most important from a therapeutic standpoint being the Klebs-Loeffler bacilli and streptococci.

What can be done by local applications to stay this process? We must remember that though the necrotic inflammation may be confined to but a small portion of the tonsillar surface, the bacillus diphtheriæ is found to exist in all parts of the pharynx. When we remember the difficulty surgeons have in disinfecting skin-surfaces, we are forced to realize the utter impossibility of wholly disinfecting the irregular and inaccessible surfaces of the naso-pharynx. It is easy to understand that the slightest injury to the mucous membrane may afford a new opportunity for fresh inoculation. With these facts in mind, is the physician justified in attempting by topical application of irritants or caustics to abort the disease? Our answer must be "No," and experience justifies this conclusion. Though the necrotic inflammation is but a finger's length within the body, and is perfectly accessible in tractable patients, we are powerless.

The pseudo-membrane may be wiped away ever so gently, the surface cauterized ever so successfully; the numerous cavities and sulci of the tonsil and the naso-pharynx are yet undisturbed. Re-forming of pseudo-membrane is but a natural result. Indeed, by denuding freshly the tonsillar surface we may really re-inoculate with the contained virus.

It was with the hope of accomplishing this disinfection by unirritating applications that Dr. Williams of Boston tried with hydrogen dioxid gently to dissolve the pseudo-membrane, destroying simultaneously the contained micro-organisms. To destroy the bacilli within a few seconds, it was found experimentally by Williams that higher percentages than the usual commercial aqueous solution, 3 per cent. (10 volumes), were necessary. By boiling such commercial articles (10 volumes) he was able to obtain much higher strengths (50 and 100 volumes), and these met the requirements, in his opinion, satisfactorily. Experimentally, a 50-volume solution destroys Klebs-Loeffler bacilli in ten seconds, and is not more irritating than the milder strengths. There is in commerce an ethereal solution of hydrogen dioxid in strengths of 5 and 25 per cent. The aqueous 3 per cent. solution is practically non-acid and unirritating, and does not decompose except in direct sunlight; in short, it serves a useful purpose in cleansing, but its strength is not sufficient to kill the Klebs-Loeffler bacilli promptly enough to be of any practical value. The stronger ethereal solutions have the disadvantage of retaining a little ether when finally transferred to an aqueous solution. In this respect the boiled-down strengths of Dr. Williams are preferable. With similar intent many

have made trial of pepsin, trypsin, papain, pineapple-juice, and other rapid solvents, but these measures have not met with the permanent approval of the profession.

Believing that all such attempts to abort the disease must be unsuccessful, what, then, may we do? Every irritating application to the mucous membrane lessens its resistance to the bacilli. Our efforts must be limited to thoroughly cleansing by unirritating agents the whole naso-pharyngeal cavity, for most bacteria there present grow more luxuriantly in the presence of dead organic matter, and muco-pus furnishes a reasonably good culture-medium.

If the nasal passages are reasonably clear, a spray of a solution of salt or of a saturated boric-acid solution will in older children serve to cleanse them. If the swelling of the mucous membrane is sufficient to interfere with free drainage, a bulb-syringe or a piston-syringe may be used, an appropriate nozzle fitting the anterior nares. Fluids, rather hot, are well borne, and serve to constringe the parts. In Figure 3 is shown a very good bulb-syringe. It is inexpensive, throws its jet promptly and sharply, and the nozzle is not so long as to injure the soft parts. For the nares the soft-rubber bulb is grasped lightly between the thumb and the fingers, the olive-shaped nozzle is placed against the nasal opening, and a steady stream is maintained for two or three seconds. Thereupon the child, according to its temperament and general early training, makes more or less ado. Very soon it learns at least that the injection is short and quickly over, and it bears this very well. Some of the fluid returns forward on removal of the syringe; some escapes by the opposite nostril; most of it passes posteriorly to the pharynx.

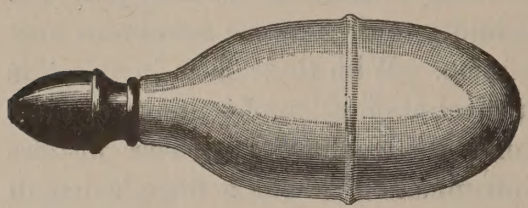
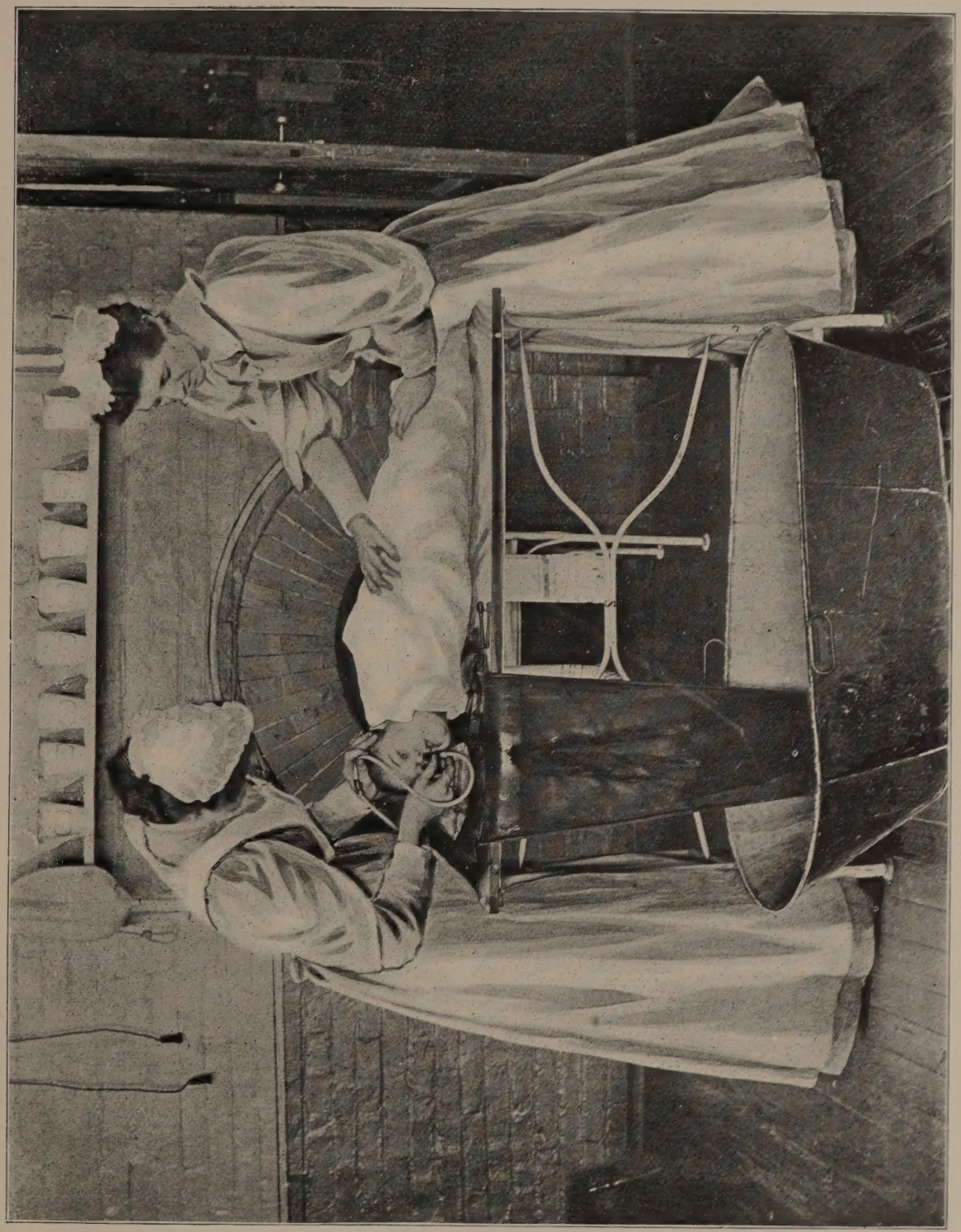


FIG. 3.—Nasal bulb-syringe.

A spray or a gargle may serve to liquefy the mucus in the pharynx and to facilitate its removal, but I certainly prefer the syringe for the pharynx, and the patient learns to tolerate it. The child may be wrapped in a blanket, hands and elbows included, and be seated on a nurse's lap or in its crib, with a basin before it. The tongue is depressed with a spatula or a spoon-handle, and at the same instant the jet of cleansing fluid is quickly and sharply thrown against the posterior wall, washing the angles and nooks of the fauces, even in some cases coming forward through the nostrils. The procedure not uncommonly induces cough, and there is reason to believe that it washes about the epiglottis and the neighboring sulci in a satisfactory manner. No spray has in my hands been so satisfactory as the bulb-douche. It washes all parts and does not bruise the tissues. The child learns after a few times just when to expect the jet, holds its breath for a few seconds, and all is quickly finished. It is usually safer to wash the pharynx and nostrils with the child in the recumbent posture, especially in cases of heart-weakness or when the child is not tractable.



Irrigation-method in use at Willard Parker Hospital, New York City.

Still another method in routine use in the Willard Parker Hospital is the employment of the fountain-syringe, with appropriate nozzles for the nostrils and the pharynx. The child, while still in the crib, is wrapped thoroughly from chin to toe in a blanket, which is then pinned. It is then laid upon a table properly spread, its head resting upon an inflated rubber pillow, from which a rubber apron leads to a slop-pail standing on the floor. In short, the patient lies so disposed that any amount of fluid may be drained from its mouth and nose without risk to the child's garments or to the floor. The little one, as a rule, makes no objection to this preparation, and the recumbent position precludes unnecessary heart-strain. A rubber-bag fountain-syringe containing the proper solution is raised to any desired height, and the nozzle with the conducting tube is led to the nostril, a spring cut-off regulating the flow. The water is allowed to flow two or three seconds, and is then stopped to allow the child to rest. After the irrigation has cleansed the nostrils a longer nozzle is attached and the posterior pharynx is washed in a similar manner. It is not uncommon after such washings of salt and water for culture-swabs to fail to bring away bacilli of diphtheria that will grow in serum-tubes, and for the septic temperature to run a lower course. The experience at Willard Parker Hospital convinces those in attendance that frequent cleansing modifies the course of a case of diphtheria materially, and leaves them in doubt whether antiseptic solutions accomplish more. A corrosive-sublimate solution of from 1 : 10,000 to 1 : 400 has been used, especially after the disappearance of the membrane. It then hastens the final disappearance of the bacilli. Its great objection is that it is irritating and gives rise to a certain amount of pain. Another cleansing fluid that I have used with satisfaction in private and hospital practice is a non-acid 3 per cent. aqueous solution of hydrogen dioxid.

Naso-pharyngeal irrigation must necessarily be somewhat irritating and exhausting, and should not be practised indiscriminately. To have any value at all irrigation should be repeated every four hours, allowing longer intervals if the child is sleeping restfully. In cases in which the secretions accumulate rapidly the intervals should not be longer than two hours.

*General Treatment.*—The systemic poisons of the disease are elaborated at the site of the local lesion. If the function of the Klebs-Loeffler bacillus is to do the greatest possible harm to the human organism, it finds its sphere of activity limited entirely to the locality of the pseudo-membrane. The poisons produced in this laboratory are readily absorbed, least through the tonsils (Hodenpyl), most through the pharyngeal tissues surrounding them. The absorbed poisons induce general symptoms—fever, anemia, prostration, especially weakening of the heart, and early albuminuria.

The known tendency of the heart to fail on exertion has always attracted attention. There seem to be two forms of heart-danger in diphtheria—that occurring early, and that late, in convalescence. Both are due to toxic absorption, and both arise through the nervous system. The former, the early depression or weakening of the heart's action, would seem to depend on an influence exerted by the absorbed poisons upon the nervous centers, analogous to that

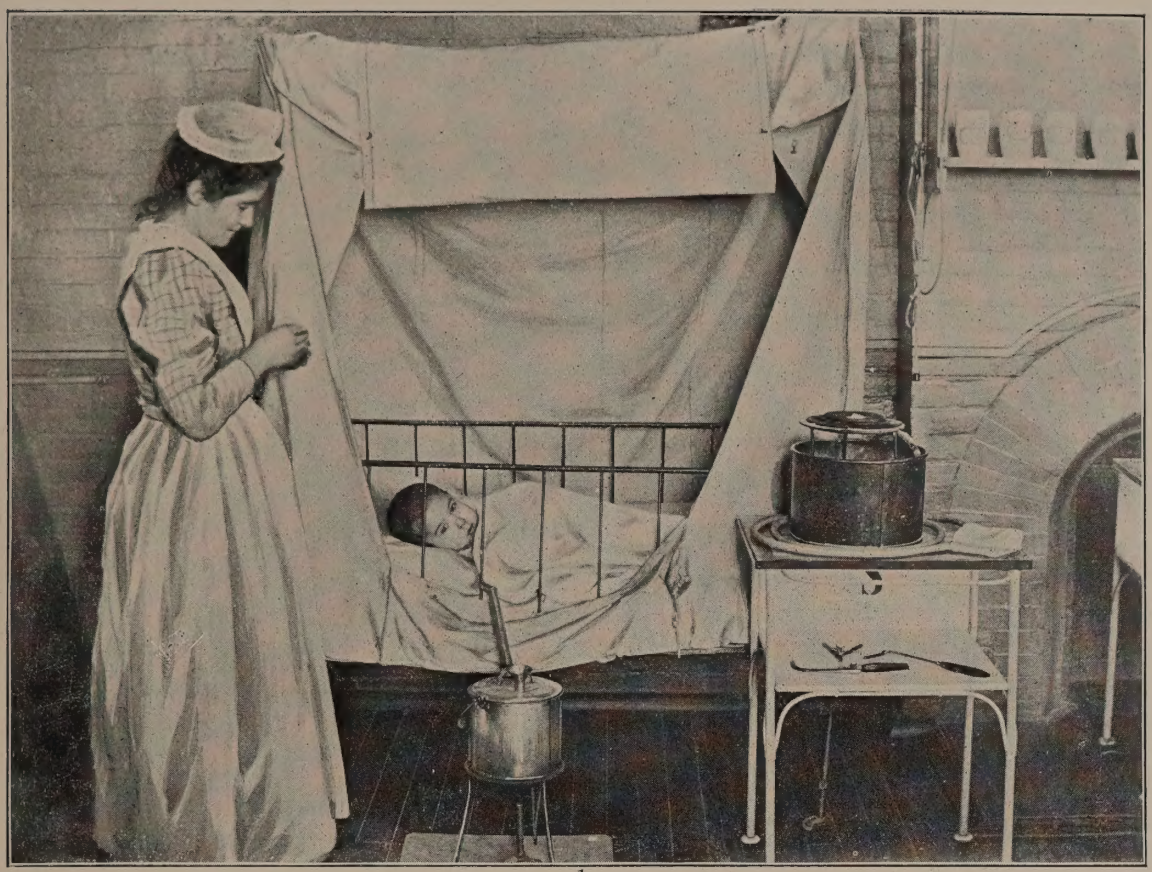
observed in all severe infectious diseases, while the latter is to be ascribed to a toxic neuritis involving the terminal cardiac filaments. The danger in the former case is that the heart's action may become gradually rapid and feeble, and that as a result of such enfeeblement the circulatory disturbances may imperil the patient's life. Among these circulatory disturbances may be mentioned edema of the lungs and acute congestion of the kidneys. The danger from the late form of intoxication is sudden death. Such an enfeebled heart may of course be subjected to a sudden strain and cease to beat. In one case the cardiac feebleness seems a part of the general septic or toxic depression of the system; in the other it is due to a degeneration of the cardiac nerves. Formerly heart-weakness was attributed to infectious endocarditis or myocarditis, to heart-clot, etc.

In combating diphtheria certain essentials are to be observed in every case. First of all we would insist upon free ventilation; second, upon nourishment; third, upon rest in bed; and finally, and of vital importance, especially in young and intractable children, upon a wise discrimination as to medications and methods adopted.

Unfortunately, the age most afflicted with the disease corresponds to the time of life when it is most difficult to control the patients. It must have occurred to all practitioners to see a small child who most needed quiet insist on being in the lap of the parents—further than that, fighting frantically against any efforts of the attendants to approach it. Often it is in accord with wise judgment to compromise with the child, even to the extent of ignominious failure, rather than to continue to urge the treatment.

A large room with numerous windows and a sunny exposure should be secured. The bed should be so placed that an abundance of fresh air may enter the room without sensible draft. A uniform temperature of about 70° F. (21.1° C.) should be maintained. Every effort should be made to secure the child abundant nourishment. The foods prepared are milk, beef-juice, scraped beef, and similar highly nutritious and readily absorbed foods. If these are refused, rather than let the child's nutrition suffer, almost anything may be permitted. If the question is one of nutrition, all medication that may interfere with this should be avoided. Nourishment should preferably be taken at regular intervals of two or three hours, according to age and the amount taken, but in many cases all regulations must yield to the whims of an unreasoning and intractable child.

Diphtheria running a mild and uncomplicated course needs no stimulant. In septic cases, when the pulse shows any tendency to become rapid and feeble, alcohol, preferably in the form of whisky, best meets the indication. In giving this, small doses should be tried first and the results watched. If the pulse improves and the mental condition becomes clearer and the temperature lower, the whisky would seem to be meeting all conditions, sustaining the system in its struggle against the poison absorbed. If the mental condition becomes duller and the pulse be not improved under increased doses of whisky, then the larger dosage is certainly not indicated. In the beginning,



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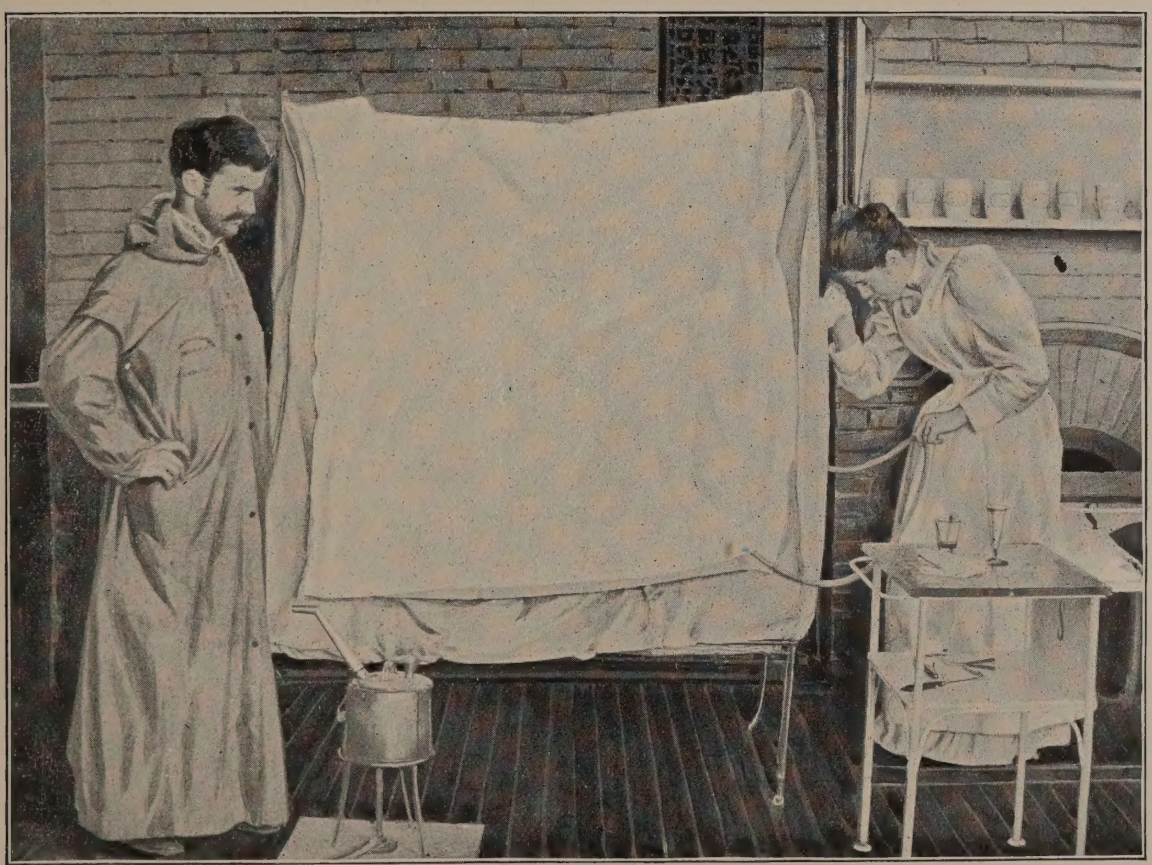

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1. Croup-tent for steaming and calomel-fumigation. The fumigation-apparatus, standing on the table, consists of a Bunsen burner, a tripod, and a plate containing calomel. 2. Calomel-fumigation at Willard Parker Hospital, New York City: croup-tent closed, nurse watching child while fumigation is going on; time, fifteen minutes; calomel, 20 grains; tent-capacity, 50 cubic feet.

doses of 20 or 30 drops diluted in at least 6 parts of water should be given every two or three hours, but in certain cases in which whisky meets the indication a half-ounce at a time may be given with advantage to a child as young as three years.

When the sustaining power of whisky is not sufficient, it should be supplemented by strychnin sulphate. A child one or two years old may take from grain $\frac{1}{100}$ to $\frac{1}{60}$ (0.00065–0.0011) every two or four hours. The drug may be given quite freely in severe cases up to the point of increasing the deep reflexes.

Tincture of digitalis or of strophanthus in doses of from 3 to 5 minims (0.18–0.31) may be given every four hours for a day or two, its effect upon the pulse being watched.

In cases of threatened syncope, aromatic spirit of ammonia, from 20 to 30 drops, well diluted in water, may be given every hour for a time, or caffein citrate may be given in doses of 1 grain (0.065), and repeated in four hours if needed.

For its general sustaining power and to counteract the tendency to anemia, tincture of ferric chlorid, from 3 to 5 drops or more, may be given in water every three or four hours. An added advantage is its astringent effect upon the pharyngeal mucous membrane. The remedy is of disadvantage when it disorders the stomach.

Potassium chlorate in large doses, from $\frac{1}{2}$ to 1 dram (2.–4.) a day, has been much used in the past, but the unfavorable effects of this drug upon the kidneys has justly caused its use to be largely abandoned.

Throughout the disease the bowels should be kept rather free by gentle salines, with the occasional use of calomel in small, repeated doses. When, on the contrary, diarrhea occurs, the antiseptic qualities of salol, 1 grain (0.065) every two or three hours, is of much advantage. This drug is readily borne, and seems to exert some favorable effect also on the lesions in the pharynx.

The remedies that have been mentioned are those of most practical utility in the general treatment of diphtheria. There has been no specific remedy except the antitoxin.

*Treatment of Complications.—Nephritis* is not usually a serious complication, certainly not so perilous as post-scarlatinal nephritis. It requires a uniform temperature for the skin—namely, protection such as bed-clothes afford. The patient must be in bed. If the urine is scanty, the bowels must be kept free by means of salines and calomel for a time, according to the age of the patient. Water should be allowed in abundance as a free diuretic and diluent; the diet should be exclusively of milk. Counter-irritation over the kidneys has seemed to determine an improved condition in the deeper organs. Poultices and cups, according to age and other conditions, may be considered.

Dover's powder of ipecac and opium, in doses suited to the age, seems to moisten the skin, to quiet the patient, and often appears to influence favorably the superficial circulation and to relieve the kidneys. Nitroglycerin, in doses of from grain $\frac{1}{500}$ to grain $\frac{1}{100}$ (0.00013–0.00065), given from every two to four hours, cautiously, has shown some of the favorable circulatory effects noted in adults. If the smallest dose, when given cautiously and under observation,

shows no favorable effects, I believe it to be of no use to increase the dose. Spirit of nitrous ether, from 10 to 30 drops in water every three hours, is often useful and acts in a similar manner. Hot baths given in conjunction with nitroglycerin, and subsequent sweating, seem to aid in relieving the congestion of the kidneys.

*Neuritis* is a post-diphtheric affection. It is either a degeneration or a real exudative inflammation of the neurilemma, with degeneration of the axis-cylinder. It often makes its appearance when the child has so far recovered as to be out on the street, some two weeks after the last of the pseudo-membrane in the throat has disappeared. The following case of post-diphtheric multiple neuritis is illustrative:

W. S., a carpenter, seventeen years old, was admitted to the Presbyterian Hospital with the following history: He had had an attack of diphtheria, and was pronounced cured of the throat-lesion three weeks before entrance. He complained of difficulty in swallowing, followed by pain and weakness in the legs and arms, and of pain along the course of the nerves of the arms and legs, followed by partial anesthesia. Then followed atrophy of the muscles of the forearm, hand, and leg, with wrist-drop and foot-drop. After a sojourn of thirteen weeks in the hospital he went out, walking fairly well, with the grip of the hand weak, but with all of the symptoms improving. The interesting features of this case are the severity of the symptoms and the favorable prognosis.

The nerves supplying the tissues nearest the lesion—that is, those of the soft palate—are the first affected, as shown by the nasal voice and the difficulty of swallowing, the fluids escaping behind the soft palate and from the nose. Later the external recti become affected, with the result that the child becomes "cross-eyed." The muscles of the neck and thorax become similarly affected. There may be multiple neuritis—arms and legs, one or all, being paralytic and locally atrophied, with loss of knee-jerks. The prognosis in this condition is encouraging. Even severe and extensive cases, with atrophied muscles, make a recovery that is most gratifying.

Every effort should be made to secure absolute rest, and general tonics—strychnin and cod-liver oil or cream—should be given. The galvanic current is of some service.

*Suppurative adenitis and abscesses of the neck* may be treated at first by local refrigeration, which seems to delay the abscess-development, and occasionally to abort the process. Ice-bags applied locally, bound on by cheese-cloth bandages, and not too heavy, are often gratefully borne and seem to improve the complicating condition. If the swelling has advanced too far, to bogginess about the glands, and suppuration seems unavoidable, it is better to incise and evacuate as early as possible. A poultice applied for from twenty-four to forty-eight hours may be advisable, for it has happened to nearly every one to cut down upon the glands early, to find no pus, and subsequently to see the parts return to the normal and the adenitis subside without suppuration. If the streptococci are liquefying the tissues within the glands, a poultice will give relief to the stretched tissues and will render the incision less painful.

When *empyema* due to streptococci occurs as a complication, it requires prompt and free drainage. If culture-facilities are at hand, as in hospital-practice, it may be advisable to ascertain whether pneumococci or streptococci are the abounding micro-organisms. If the former, the general sentiment is that it may be well to delay operation, trying methods that favor absorption. If the temperature and the general condition pursue a favorable course, delay is justified. Our working rule is: If one suspect fluid, aspirate; if one find pus, operate.

*Pleural empyema* is an exudative inflammation of the pleural membrane, in which pus is so conspicuous a proportion of the exudate as to determine the name. A serous exudate with some pus might be classed differently by different individuals. So, for that class of exudates last described, no indications pointing otherwise, and if the amount is small, we recommend delay and counter-irritation, and in this manner: Apply strips of cantharides-plaster, narrow and long, to facilitate rapid restoration of the scarf-skin. The length may be various, from two to three inches, while the width is but half an inch, and the strips are so tilted as to drain well from one end when the blister is snipped. Leave room enough between the plasters to put a second series of similar plasters alternating. In this way continuous irritation may be kept up, and yet the patient be left with no seriously denuded moist surface. Partial aspiration and counter-irritation lead to improvement in a few cases of sero-purulent pleurisy, and it is for this small proportion that the suggestion is made. Most cases will do well if the purulent collection is opened freely and early, but there arise many and various reasons that call for delay.

*Broncho-pneumonia* is touched upon here only as an important complication of diphtheria. The subject in its general aspect is treated of at length elsewhere. It has been proved by some work in which I was associated with Dr. T. M. Prudden that the broncho-pneumonia following diphtheria in one epidemic was due largely to streptococci. Doubtless the Klebs-Loeffler bacillus is one of the etiologic factors in many cases, and the sole cause in some. The point illustrates the important part the streptococcous complications play in the therapeutic side of diphtheria.

*Laryngeal Stenosis* ("Membranous Croup").—When diphtheria invades the larynx, it regularly gives rise to such severe and urgent symptoms as to justify special consideration here. We may practically consider all cases of pseudo-membranous laryngitis as diphtheria. Park found positive proof of diphtheria in cultures of 80 per cent. of cases examined.

The characteristic symptoms of pseudo-membranous croup are, in the order of their usual appearance, hoarseness, croupy cough, aphonia, croupy inspiration, croupy expiration, recession of the thoracic soft parts, and cyanosis. These symptoms fall into three stages: In the first stage there occur hoarseness, croupy cough, aphonia, and croupy respiration, without symptoms of obstruction. In the second stage the dyspnea is spasmodic or intermittent, and in the third stage it is abiding and progressive.

In this connection it may be useful to present a memorandum of points in

favor of a diagnosis of catarrhal croup, or so-called "false croup:" *Catarrhal croup:* 1. Sudden onset of all symptoms; 2. Conspicuously spasmodic in character; 3. High initial temperature would rather favor catarrhal than membranous croup; 4. Short course.

In acute laryngeal stenosis ("membranous croup") we shall assume that we have to do with diphtheria, true or false, involving the larynx in children.

Calomel-fumigation often affords relief from the urgent symptoms when no other medication will, and helps the patient to survive the stress of the disease without operative procedure.

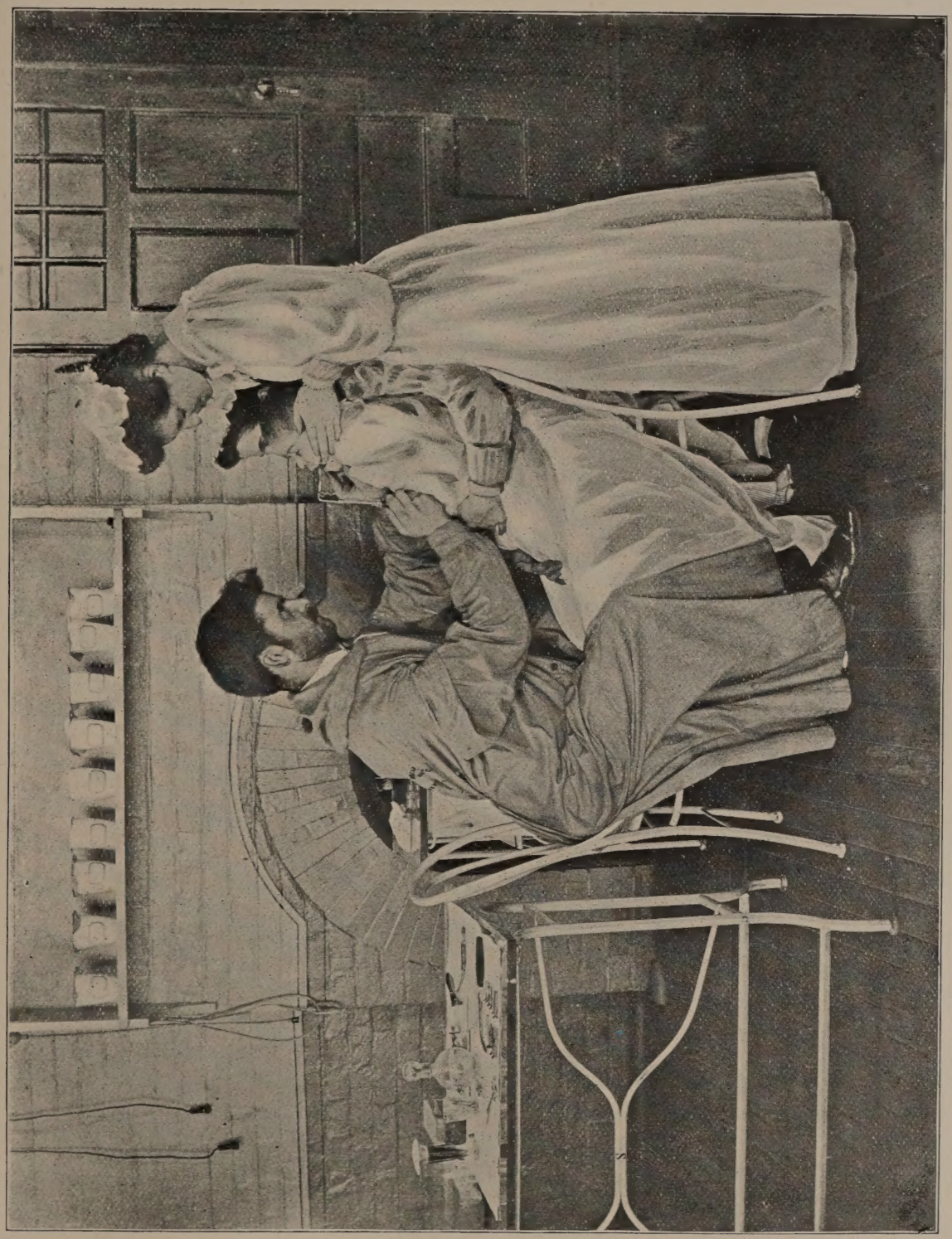
**Intubation.**[1]—Progressive dyspnea uncontrolled by calomel-inhalations comes at length to require operative interference. Our part is to speak of intubation, and we shall discuss it under the following heads:

When to operate;
How to operate;
How to remove the tube;
When to remove the tube;
Dangers and difficulties of the operation;
Dangers and difficulties of wearing the tube;
Dangers and difficulties of removal of the tube, and thereafter;
Advantages of intubation.

*When to Operate.*—When, despite all previous treatment, progressive, unremitting dyspnea interferes with the inflation of any considerable part of the posterior portion of the lungs, when the labored breathing begins to produce sensible exhaustion, intubation is to be performed promptly. From this moment nothing but harm can come to the lung and the heart unless relief is afforded. If air cannot be aspirated, blood will be, and pneumonia is invited.

*How to Operate.*—The technic of intubation having become so thoroughly a matter of literature, we shall emphasize only certain points. Wrap the child from the chin down in a light blanket, shoulders, arms, and hands included. Pin the blanket closely about the neck, and yet do not make a bulky roll to interfere with depressing the handle of the introducer. In this way the elbows are pinioned to the side and the hands are held across the child's abdomen. These precautions cause no annoyance to the child; it does not worry or resist, and when the time for rapid action arrives it cannot move. The nurse who is to hold the child should sit in a high, firm chair, bolt upright. The child should be placed upon her lap, nurse and child exactly facing the operator. The nurse being upright, not leaning back, should grasp the child's elbows firmly—outside its winding blanket, of course—and clasp the child's legs between her knees, making sure she twines her own legs about those of the child. All these precautions are to secure the child in a firm grasp, to immobilize it without interfering with the expansion of its chest, and may be taken without causing any apprehension or excitement. *The position of the child should be as though it hung from the top of its head.*

[1] Based upon a discussion by the writer before the British Medical Association, Bristol, 1894. Reported in the *Journal of Laryngology*, London, Oct., 1894.



Intubation: correct position of operator, child, instruments, and assistants; the left hand of one assistant holds the child's head and the gag in the same grasp.

The physician or nurse assisting should stand behind the chair of the nurse holding the child, grasp the child's head between the hands, hold it firmly, and when the gag has been inserted include it within the grasp to ensure its firmness and steadiness. The operator, seated or standing squarely facing the child and nurse, inserts the gag, opens the mouth widely, and gives the handle into the keeping of the assistant. At this point, for the first moment, the child worries; yet from this point to the end of the operation need occupy but a few seconds, though it takes some moments to describe what is done. The introducer, armed with the proper-sized tube, is supposed to be threaded and at hand.

Just at this point it is well for the operator to be sure that all the foregoing directions have been carried out carefully, that the position is exact, the gag well held, the grasp firm. A moment suffices, and it is time well spent. Next he inserts his left index-finger, hooks up the epiglottis, crowds his finger to one side, passes the tube past it till it engages in the chink of the glottis, elevates the handle, and gently passes the tube down till the head is within the box of the larynx and the introducer lies crowded upon the tongue. He then with the trigger loosens the obturator, holds the tube with the left index-finger while withdrawing the obturator, and with a gentle thrust presses the head of the tube

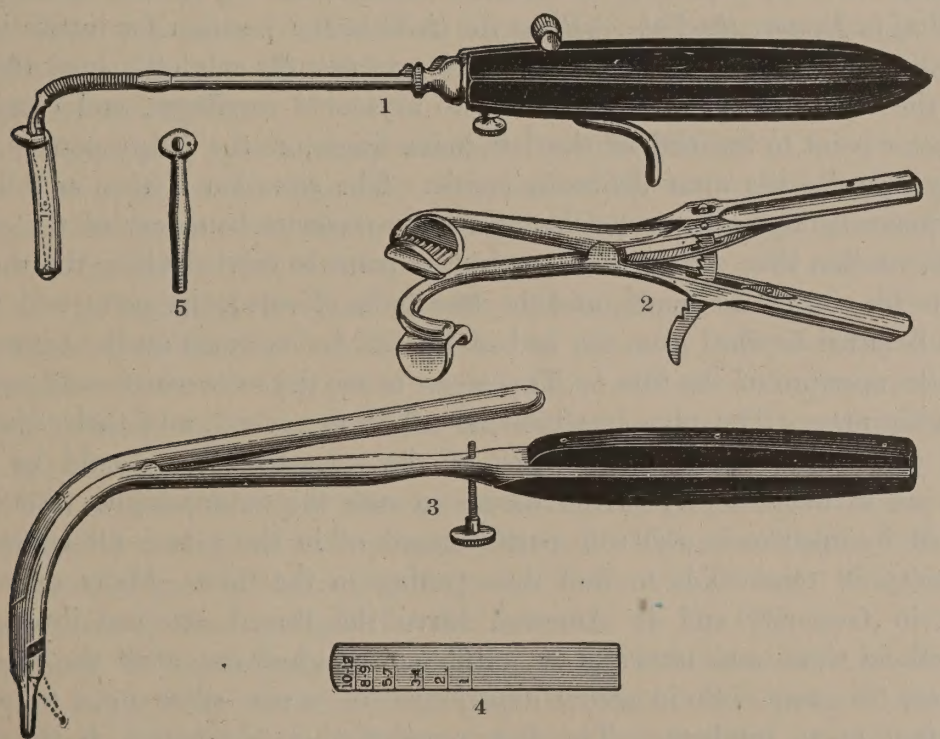



FIG. 4.—O'Dwyer's intubation-set (Ermold): 1, introducer with tube adjusted; 2, mouth-gag; 3, extractor; 4, gauge; 5, detached tube, anterior view.

well into the larynx and removes the finger and gag. Just here let me emphasize what has already been stated: keep the introducer in the middle line, otherwise the obturator will pinch in the caliber of the tube and drag the tube with it as it is withdrawn.

The handle of the introducer should be held most lightly between the end of the thumb and the fingers. In this way it is impossible to use enough force to make a false passage. It is easy for a right-handed operator, inadvertently, to carry his handle to the left of the child's middle line. Often the child manages by an effort to slip down in the nurse's lap, while the grasp that the assistant exerts tilts the head back, and the tube may then impinge on the anterior wall of the larynx. The lines and angles must be maintained to ensure quick intubation. Carelessness and failure to observe these points explain many failures of inexperienced operators.

Again, suppose that on the first attempt the tube is not successfully placed in the larynx? How long shall one try? Shall one repeat the attempt? It is better to make repeated short attempts than to prolong a single attempt.

Having placed the tube in the larynx, there will be rattling in the tube on first respiration, and subsequent cough and expectoration. A vigorous cough argues well for the sensitiveness of the parts and for evacuation of accumulations below. The gag is removed as soon as the tube is in place, but not so the thread; it must remain till it becomes evident that all obstruction to breathing has been overcome, and that no partially detached false membrane is in the trachea below the tube. The thread at first acts as an inciter to cough, which is desired; ordinarily ten minutes are sufficient.

*How to Remove the Tube.*—Place the child in the position for intubation as already described. Thrust the left index-finger past the epiglottis, hook this up, rest the tip of the finger upon the two arytenoid cartilages, and carry the extractor-point to the end of the left index-finger, at the pulpy portion generally regarded the most delicately tactile. The situation is then as follows: The finger-tip upon the arytenoids marks the posterior boundary of the glottis in the median line. Now, if the extractor-point be carried along the median line to the end of the finger, and the handle be elevated, the point will naturally be pried forward from the end of the left index-finger on the arytenoids into the aperture of the tube.[1] This seems to me the most satisfactory method for a beginner. The plan has been described to several, and their successes have justified it. The guard-screw of the extractor-lever should be carefully set to avoid injury to the tissues in case the extractor-jaws should be opened by mistake in the soft parts instead of in the tube. Of course the difficulty in removal is to find the opening in the tube. Many operators, both in Germany and in America, leave the thread attached throughout the whole time, and occasionally a tube is coughed out after the swelling releases its grasp. So in actual experience one is not called upon to extract so often as to intubate. The fact remains that extubation is the more difficult.

[1] Occasionally cases are found in which the epiglottis hugs so closely the head of the tube that it is very difficult to raise the part and keep it out of the way. This is especially liable to occur in ascending croup, in which the epiglottis is not always involved in the diphtheric process. In such cases the extractor would be guided better with the left index-finger *at the side*, as in intubation.

*When to Remove the Tube.*—This depends on the age of the child and the duration of the disease before intubation became necessary. The older the child, the earlier can the tube be dispensed with. Estimating the maximum of the disease to be seven days, five days' wearing of the tube may be considered, on an average, sufficient.

*Dangers and Difficulties of the Operation.*—In the hands of an *experienced* operator there are practically *no dangers to life* at the time of the operation. A few authentic cases of pushing down membrane before the entering tube have been recorded. It happened to O'Dwyer three times in his first two hundred cases on first intubation. Expert intubation presupposes that the thread has been left attached, and therefore easy immediate removal is possible. What does it mean, then, to push loose membrane into the trachea—from tissues above the larynx, for instance? It means more room in the larynx. If the tube is removed, the mass of membranes is forcibly ejected, and the patient is really benefited by the procedure, and at no time endangered. This experience with loose pseudo-membranes occurs more often late in the disease and in reintubations.

To the *inexperienced* there are many dangers. Among these are (1) asphyxia from prolonged attempts and (2) laceration of the parts, false passages, etc. The explanation usually given to these two most common accidents is "pushing down false membrane." So-called "syncopal" attacks are simply lesser attacks of asphyxia. Convulsions are recorded, and instruments have been broken, in intubation.

An experienced operator may encounter two difficulties:

1. The point of the tube may enter one of the ventricles of the larynx. This accident is not common, for the original disease usually fills and obliterates these cavities. Such obstruction, however, does occur. It may readily be seen how an inexpert, sure that his tube and handle are exactly in the middle line, might force his tube into the tissues of the neck. He certainly has but to remember the cardinal points of advice and he will use more gentle pressure; indeed, he need but look at the light introducing instruments to appreciate that they are intended for delicate work.

2. The second difficulty or obstruction that an experienced operator may meet in intubation is subglottic stenosis, or what is so often described as "edema." The narrowest part of the respiratory ways is the cricoid ring. This fact, so far as I know, came to light for the first time in Dr. O'Dwyer's early investigations in intubation. If the head of an intubation-tube be forcibly crowded down from above, it may pass the vocal bands and yet resist all effort at the cricoid ring. Given a resisting cartilaginous ring lined with mucous membrane, we have the very elective conditions for stenosis. Fortunately, the swelling and infiltration are not often extensive enough to cause serious obstruction, but they may be. Operators come upon cases in which the properly selected tube surely passes into the larynx, and yet encounters resistance—even "creeps back," as some one has said, "like an oiled cork in a bottle." If one is sure of the diagnosis, and a proper size fails, a smaller

tube may be introduced with moderate pressure. This is the only condition under which force is justified in intubation.

*Dangers and Difficulties of Wearing the Tube.*—1. The tube may become obstructed by loosened plaques of false membrane. This constitutes the one important danger in wearing an intubation-tube. It is easy to understand that large plaques may become loosened and detached in the trachea, especially after several days of the disease. A detached plaque may act like a valve at the tube's lower end, closing on expiration, opening on inspiration, till the lungs become quite distended from accumulated air. This is exactly what happened in three of O'Dwyer's first two hundred cases, with three deaths.

At this point I may refer to the symptoms of loose membrane: (1) croupy character of cough (the tube being in place); (2) a flapping sound; (3) most important, a sudden obstruction to the outgoing air, especially during coughing.

If the string had been left attached in O'Dwyer's three fatal cases, this danger would have been obviated. Most Continental operators loop the thread about the ear, protecting it along the cheek with rubber adhesive plaster, and leave it throughout the wearing of the tube. This is advisable outside of a hospital, with beginners, and in case loosening pseudo-membrane is suspected in the trachea. Possibly there may gradually collect in the tube, especially in mouth-breathers suffering from high temperature, mucus of such a tenacious quality that it becomes an embarrassment or even a danger.

*Short Tubes* (*Loose-membrane or Foreign-body Tubes*).—At this point I shall call attention to the special tubes devised for the easy expulsion of loose membrane and foreign bodies. They are short, hollow cylinders of large caliber—short enough not to push down the tracheal membrane, yet long enough to reach below the cricoid stenosis, and large enough to permit masses to pass through them. Occasionally a long tube loosens the upper attachment of a tracheal cast and crumples it into a wad below the end of the tube. The usual result is, as would be expected, profound dyspnea. Immediate removal of the tube is commonly followed by either expulsion of the cast or other disposal of the mass in the comparatively large trachea. At this point, when the long tubes have failed to give relief, the short cylinders become of temporary service. These tubes are of various sizes and are seven in number. As they have no retention-swell, it is necessary to use the largest size possible, wedging the tube into the larynx, and, for obvious reasons, in the line of pressure, not leaving it more than a few hours in place. These tubes require a special introducer with a long curve, in order to carry the short tube well through the cricoid constriction before withdrawing the obturator. In short, to allow the expulsion of loose membrane from the trachea the largest possible hollow cylinder is passed through the narrowed larynx, is allowed to remain for a short time, and is removed as soon as the resulting cough has expelled the foreign body requiring its insertion.

2. Ulceration from too large a tube making pressure within the cricoid ring, and ulceration at the lower end of the tube, are complications sometimes encountered. The former may be of a serious nature, destroying the cartilage;

the latter is superficial and of little import. Ulceration within the cricoid ring is due to improper size of the instrument used; ulceration below, to improper construction of the tube.

Properly constructed tubes are difficult to describe, and more difficult to secure from a maker, even if a most faithful and conscientious servant. There

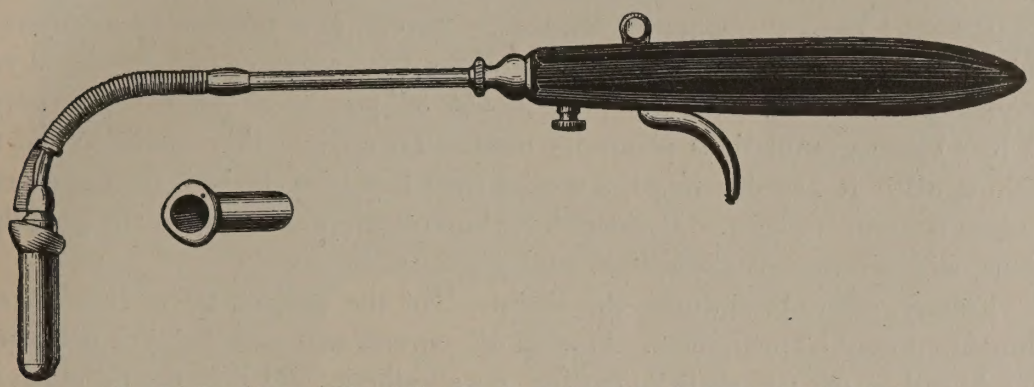


FIG. 5.—Short large-caliber tubes (foreign-body tubes; loose-membrane tubes).

is but one maker who has succeeded in making tubes that embody all the ideas of the inventor. Every swell and knob, every constriction and crease, every hole, the canting back of the head or collar, all are the work of the inventor, with the object of having the tube conform to the anatomy of the parts.

*Feeding an Intubated Patient.*—There is one disadvantage after the operation: feeding is difficult. The larynx is sore. Many times the soreness is increased because of the inexperience of the operator. The less the larynx is bruised in intubation, the less the child will dread the clasp of the pharyngeal muscles in the act of deglutition. The fact remains that there is more or less difficulty in swallowing, from both pain and cough. The latter arises from the entrance of fluids into the trachea, though many patients learn to swallow very well. The method of feeding adopted by Dr. Casselberry of Chicago has very much relieved the situation. The child is inclined head down, so that it swallows uphill, and any fluid that may get into the tube in the act of deglutition quickly gravitates out again. The directions are as follows: Place the child across the nurse's lap; bend the head well down, and feed either with a spoon or through a nursing-bottle. At first the patients object, but when they learn that under the new conditions they can swallow without coughing, they give no further trouble.

Medication can be continued after intubation as well as before.

*Dangers and Difficulties of Removal of the Tube, and Thereafter.*—If the tube is removed on the fifth day in a case having an average fair course, there is little or no danger. The operator should remain half an hour. If in this time there have been coughing and clearing of the throat and trachea, and no loose pseudo-membrane remains, and no dyspnea, there will be no sudden or urgent necessity of rapid reintubation. Even yet it is deemed desirable to be within easy call for some hours.

I once considered that I had, on an average, four hours' leeway; but,

exceptionally, prompt aid was needed sooner, and a few cases needed re-intubation twelve and twenty-four hours afterward. Whether, with the pressure of the instrument removed, the mucous membrane becomes quickly congested, or whether muscular spasm sets in or membrane re-forms, I do not know, but I have learned to respect the emergency of the first twelve hours after removal of the tube, especially if the removal be a premature one.

*Retained Tubes* (*Laryngeal Cannulæ*).—Rarely, it is necessary to reinsert a tube many times. The child may get on for half a day or two days, and yet require reintubation. If the tube is not of proper anatomic conformity, it may cause granulations about its head. To obviate this condition and to cure it when it has developed, a special tube has been devised, having a prolonged or built-up head. It rides above and causes pressure upon the granulations, with consequent absorption.

Finally, not to recapitulate the literature of the subject, the advantages of intubation may be mentioned. *First of all, parents will consent.* The operation is a bloodless one; there is no cutting, no anesthetic, and this means much to the friends. It is quickly performed, and it requires no trained assistants or trained attendants (it is trained operators that are needed). The air inspired is warmed and moistened through the natural passages. The results are equal to, or rather better than, those of tracheotomy under similar circumstances, whether in hospital or outside.

**Tracheotomy.**—The indications for tracheotomy are the same as those for intubation. When a progressive, unremitting dyspnea has advanced so that air ceases to enter the posterior portions of the lungs, then delay must result in harm to the pulmonary tissues, and operative interference is required. The two most important pathologic conditions in which tracheotomy promises more sure relief than intubation are the following:

(1) Pronounced naso-pharyngeal obstruction complicating the laryngeal obstruction for which the operation is to be undertaken. Intubation would relieve the glottic stenosis, but not the naso-pharyngeal, and consequently not the dyspnea. These are usually very malignant, rapidly fatal cases, and the operation is to be undertaken with little hope beyond that of affording temporary relief.

(2) Extreme degree of infiltration of the epiglottis and ary-epiglottidean folds, which close in over the head and proximal orifice of the tube. The remedy here is either larger-headed intubation-tubes or tracheotomy. The tube-head may be enlarged in an emergency by slipping over it a piece of rubber tubing or by winding it with thread or with soft twine.

Intubation may be employed as a tentative operation in all cases in which doubt exists as to diagnosis of the exact seat of obstruction.

Tracheotomy is preferable to intubation when there is any question of experience and skill in the latter; that is:

(1) In case the operator has not had intubation practice enough upon the living or upon the cadaver to render him intelligently confident that he can intubate without immediate danger to life. When it is a question of expe-

Method of feeding infant after intubation, with the head lower than the body (from *An American Text-Book of the Diseases of Children*).

rience and skill, it is better to operate on tissues in plain view by tracheotomy.

(2) In cases of obstruction to intubation from an entered ventricle or from subglottic stenosis (both rare). When an intubation-tube has once entered a ventricle of the larynx, it is likely to render subsequent attempts at intubation unsuccessful and somewhat dangerous. Undue pressure will force the tube through the ventricle and into the tissues of the neck, causing dyspnea and death. On the contrary, a moderate amount of force with a small-sized tube is justifiable in subglottic stenosis. In case the exact cause of obstruction cannot be made out, tracheotomy is preferable to the use of force in intubation.

(3) In case of loosened plaques in the trachea. Tracheotomy has been advised as affording a means of escape for abundant loosening tracheal pseudo-membrane, affording drainage for pus and detritus as well. It is also thought to be of advantage to have a window through which the operator may angle for bronchial casts and the like. Intubationists think they attain the same results with the short large-caliber tubes—the so-called "foreign-body" tubes.

(4) Tracheotomy after unsuccessful intubation. When the intubation-tube has from any cause failed to enter the larynx, and when, after entering, it fails to relieve the dyspnea, the operator, unless familiar with all the devices for relief by intubation, should not exhaust his patient by repeated unsuccessful attempts, but should resort at once to the open surgical treatment of free incision and drainage.

### The Antitoxin and the Antitoxin-treatment.

The antitoxin of diphtheria is a substance derived, for therapeutic purposes, from the blood of animals, chiefly from horses, which have been rendered immune to the action of diphtheria-bacilli through repeated injections of their toxins (Park). The toxins are poisonous chemic compounds produced and set free in connection with the growth of the diphtheria-bacilli. They act as powerful poisons to the living cells of the body, causing their death, "coagulation-necrosis" in the mucous membranes, the pseudo-membranes so called; also the necrotic foci in the internal organs, and the general systemic poisoning and prostration.

To produce the antitoxin in quantity, a large animal, the horse, is selected, and into it the toxins produced by the growth of virulent diphtheria-bacilli are injected in tentative, increasing doses as tolerance is established. When large quantities of strong toxin can be injected into the horse without causing serious symptoms, the blood of the animal is presumed to contain enough antitoxin for therapeutic purposes. It is necessary then to test the strength of the toxins and of the nullifying antitoxins, and to establish a standard unit of comparison. The standard unit of strong toxin is the quantity that, when injected to the amount of $\frac{1}{10}$ of a cubic centimeter into a guinea-pig weighing from 250 to 300 grams, is sufficient to kill the animal in from thirty-six to forty-eight hours. The standard unit of antitoxin is found by neutralizing ten times the fatal dose in a guinea-pig. When the horse-antitoxin becomes of such strength that $\frac{1}{10}$ of a cubic centimeter will just neutralize the effect of a tenfold fatal

dose in a guinea-pig weighing from 250 to 300 grams, the serum is arbitrarily pronounced a *normal antitoxin-solution.* One cubic centimeter of this solution is likewise pronounced one *unit of antitoxin* (*immunity-unit*).

In the prevention of diphtheria by the use of the antitoxin a certain portion of the immunifying faculty that has been artificially established is transferred from the immunized animal to the individual treated; the amount of insusceptibility thus transmitted being proportionate to the amount of blood-serum introduced and the degree of insusceptibility to diphtheria possessed by the animal yielding the serum.

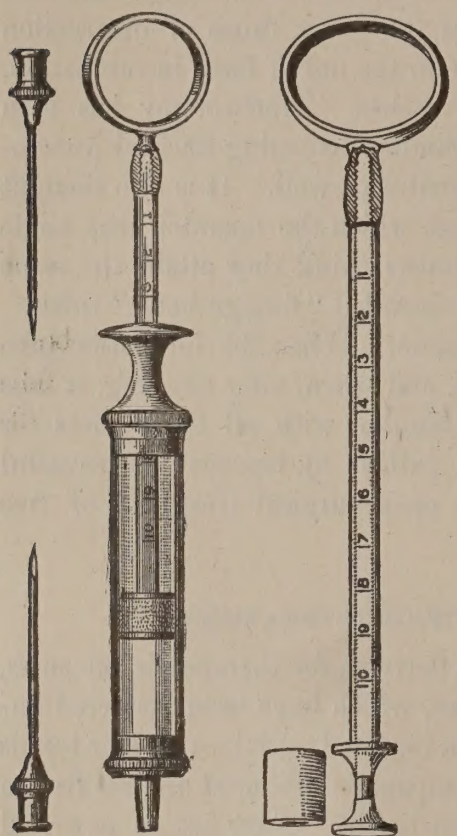


FIG. 6.—Antitoxin-syringe. Asbestos-packing.

The antitoxin nullifies the toxins of the virulent bacillus diphtheriæ and none other. It is not claimed to have effect upon the toxins of the streptococcus. Therefore the lesson from the animal experiments holds good exactly: the antitoxin is antidotal to the toxin of the Klebs-Loeffler bacillus, pure diphtheria. Further, the animal experiments teach that the antitoxin should be administered early—in the first twenty-four or forty-eight hours. The quantity to be injected will depend upon the strength of the solution, and will always be found stated among instructions accompanying a given product. The dose of Behring's No. II. is given as 10 cubic centimeters for a curative effect in children, used early, and one-fourth that amount for immunizing exposed children. The dose is to be repeated three times at intervals of from twelve to fourteen hours.

The elective site of injection has varied in practice. At the Willard Parker Hospital most injections have been in the loose connective tissue below the nipples. No unpleasant results have been observed from injecting large quantities in one place. Even when the accumulated injection-fluid bulges the skin very much, absorption soon takes it all away, without pressure and without massage. No local abscess arises from the injection, and it may be placed in any loose connective tissue.

The syringe best adapted to the injection of the antitoxin is one specially made for the purpose, and so constructed that it can be boiled without being taken apart. Asbestos piston-packing or rubber packing has been found best adapted to the purpose. The capacity of the syringe is usually from 10 to 20 cubic centimeters. It is especially desirable to have a properly constructed syringe, as the antitoxin is rather a "sticky" fluid and is not easily removed from the interior surfaces.

A masterly summary of the present status of the treatment of diphtheria with the antitoxin has recently been made by Prof. W. H. Welch,[1] and I cannot do better than to quote liberally from this important communication:

"Unless one denies absolutely the causal relation of the Loeffler bacillus to diphtheria, it must be admitted that the treatment of this disease by antitoxin rests upon a sound experimental basis.

"No one can claim that laryngeal diphtheria requiring intubation or tracheotomy is anything but a severe disease. If the benefits of antitoxin are unmistakably manifested in these operated cases of croup, then the test is an *experimentum crucis.*

"Of . . . . 4294 cases . . . . 27.2 per cent. required tracheotomy or intubation. There were, however, many more cases of laryngeal diphtheria in this group than the ratio of operative cases would indicate, for it is the testimony of the great majority of the observers that the stenotic symptoms of laryngo-tracheal diphtheria are relieved without the necessity of operation in a much larger proportion of the cases treated with antitoxin than by any other method of treatment. As is well known, recovery without intubation or tracheotomy from descending laryngo-tracheal diphtheria, especially in children, is exceptional under all other methods of treatment, and the greater relative frequency with which such recovery occurs under serum-treatment is a strong proof of the efficacy of antitoxin.

"If for each group of cases we estimate the number of deaths which would have occurred in the tracheotomized cases treated with serum on the assumption that the previous or simultaneous fatality in cases not treated with serum had obtained, we obtain the following result: The actual percentage of deaths in 510 tracheotomized cases treated with serum was 42.5. The percentage of fatality in these cases estimated on the basis of previous or simultaneous fatality in the same hospitals would be 64.5. There was therefore an apparent reduction in fatality by the serum-treatment of 34.1 per cent. This difference between actual and estimated fatality is greater than is observed in any ordinary experience of variations in fatality during a series of years in the same hospital from tracheotomy in diphtheria.

"The fatality of intubated cases . . . . treated with antitoxin is 28.9 per cent., which is 10.9 per cent. less than the fatality of tracheotomized cases. Before the introduction of the serum-treatment a collective investigation was set on foot by the German Gesellschaft für Kinderheilkunde to determine the average fatality following intubation. In 1893, Von Ranke reported to the society that 1445 cases of diphtheria with laryngeal stenosis treated by intubation gave a fatality of 62.5 per cent. This result was interpreted in favor of intubation as opposed to tracheotomy. There is a difference of 33.6 per cent. between this percentage and that obtained from our 342 intubated cases treated with antitoxin. This difference is so great that, after making all possible allowance for differences in the series of cases entering into

[1] *Transactions of the Association of American Physicians*, 1895; *Bulletin of the Johns Hopkins Hospital*, Nos. 52, 53, July and August, 1895.

the two groups of statistics, it seems impossible to explain it otherwise than as a powerful additional support of the arguments already presented in support of the claims of antitoxin. Here certainly the objection that the cases treated by antitoxin were light ones cannot be made.

"In twenty-four to forty-eight hours after the injection the general condition of the patient is remarkably improved in the great majority of those patients who are in a condition to be benefited at all by antitoxin. This general improvement is accompanied by a fall of temperature, which may be a critical fall, especially if the disease is not far advanced; often it is a fall by lysis. Some hold that there may be a temporary rise of temperature as an immediate effect of the injection. Accompanying the fall of temperature is improvement of the pulse as to frequency and tension, but the heart's action may for some time, even into the period of convalescence, remain weak.

"In the favorable cases the local diphtheric process is arrested, usually within the first twenty-four hours after the injection. Membrane may appear upon spots previously inflamed and invaded by the bacilli, but otherwise there is no extension of the membrane in the majority of the cases which are benefited. The area covered by membrane becomes sharply demarcated and the swelling of adjacent mucous membrane disappears. The membrane may disappear by rapid separation or by gradual softening. Sometimes it persists for several days after disappearance of all other local disturbance. Large membranous casts are coughed up from the larynx, trachea, and bronchi under the serum-treatment more frequently than under former methods. The rapid separation of the membrane in the lower air-passages may cause sudden increase of stenotic symptoms. Nasal discharge is lessened. The swelling of the glands in the neck and the surrounding edema disappear, so far as these are not referable to secondary infections.

"The most uncertainty prevails as to the influence of antitoxin in preventing the three most important complications or sequelæ of diphtheria, nephritis, heart-failure, and paralysis. The weight of evidence is that genuine nephritis is far less common in cases treated by antitoxin sufficiently early than under other methods of treatment, but it is questionable whether albuminuria is less common, although it is considered to be by Kossel, Roux, and others. If there is an albuminuria in any way directly referable to the injection of the serum, and this is by no means established, it is simple albuminuria with perhaps a few narrow hyaline casts but without evidence of any serious damage to the kidney. Peptonuria, it is claimed by Hecker, is an effect of the serum, but it is without clinical significance. Albuminuria is such an extremely common symptom of diphtheria that it must be very difficult to determine that it can be referred to the serum in any case.

"Many writers emphasize especially the favorable influence of antitoxin upon the heart, but there are some who have observed that with decided improvement in all other symptoms the force of the heart may still remain weak and occasion anxiety. Baginsky's experience is that the minor disturbances of the cardiac action are not less frequent in cases treated with serum;

they appear to be even more frequent, as a larger number of cases survive; but that actual death from heart-failure is far less common in the serum-cases than in others.

"Post-diphtheric paralyses may occur in cases treated with serum as early as the second or third day of the disease. Whether they occur in cases treated within the first twenty-four hours is not certain. According to some, paralysis is even more common in the serum-cases than under former methods of treatment. This is doubtful, but if true it may be attributed to the survival of a larger proportion of cases.

"It is apparent from what has been said that antitoxin is most strikingly beneficial in progressive fibrinous diphtheria and especially in the prevention and cure of laryngeal diphtheria. In septic diphtheria the serum-treatment is of little avail.

"Antitoxic serum may produce unpleasant effects, but these do not involve danger to the patient. They are in all probability referable to the serum as such, and not to the healing, so-called antitoxic, substance contained in the serum. The most common undesired effect is some form of exanthem, usually erythema and urticaria, sometimes an eruption like measles or scarlatinal rash.

"The serum from some horses is more likely to cause these exanthems than that from others, and there may be individual idiosyncrasies favoring their occurrence. Often without noticeable fever they may be accompanied by considerable elevation of temperature and by pain and swelling in the joints. A rarer but more severe form of serum exanthem resembles erythema multiforme, and when this is accompanied, as it may be, by high fever, and severe pain in the bones and joints with swelling of the joints, the condition of the patient may really seem serious, but these patients recover. Some have attributed a petechial eruption to injection of the serum, but this may occur in diphtheria without serum-treatment.

"These occasional untoward effects of the healing serum are annoying, but, being unattended with danger to life and without serious consequences, they do not contraindicate the use of the serum.

"There have been a few cases reported in which the writers, without any satisfactory evidence whatever, have referred the death of the patient to the use of the serum. The essential harmlessness of the serum has been demonstrated by over a hundred thousand injections, and if future investigations should show that through some idiosyncrasy on the part of the patient death ever is attributable to the injection of the serum, this would probably count for about as much as the rare deaths from the use of ether or chloroform.

"The principal conclusion which I would draw from this paper is that our study of the results of the treatment of over 7000 cases of diphtheria by antitoxin demonstrates beyond all reasonable doubt that anti-diphtheric serum is a specific curative agent for diphtheria, surpassing in its efficacy all other known methods of treatment for this disease. It is the duty of the physician to use it."

# WHOOPING-COUGH.

By LOUIS STARR.

In undertaking a study of the treatment of whooping-cough little time need be spent in speculating upon the etiologic factors concerned. No argument is needed at the present day to prove pertussis an infectious, highly contagious disease, due to the presence and activity of a definite poison; and, in the light of modern pathologic research, there can be little doubt that this specific cause is a microbe, either the bacillus cultivated and described in 1887 by Afanassiew, or possibly the diplococcus observed by Ritter in 1892. Investigation, however, is still wanting to prove conclusively —as may be said to have already been done for diphtheria—just how the micro-organism or its products act in the causation of the peculiar and characteristic phenomena of the disease. It is as yet impossible to state whether the infection is purely a local one (like that of gonorrhea, as Ollivier ingeniously suggested), confined especially to the mucous membranes of the nasal passages, the larynx, and the upper portion of the trachea, or whether it is general and systemic, but acting with greatest force and concentration upon these special areas of the respiratory tract.

Von Herff[1] has shown, from a study of his own larynx, that during the whole course of the disease there exists an inflammatory condition of the respiratory tract, extending from the posterior nares to the bifurcation of the trachea, the intensity of which inflammation varies in different parts, being quite pronounced at the arytenoid cartilages and the cartilages of Santorini and Wrisberg, but most severe on the posterior wall of the larynx, between the vocal bands, and on the inferior surface of the epiglottis. During a paroxysm a small pellet of mucus was observed on the posterior wall of the larynx, at the level of the glottis, and the coughing ceased with the removal of this offending substance. Mechanical irritation of this region also provoked cough, while other parts could be touched without giving rise to a paroxysm. It therefore seems quite certain that in pertussis we have to do with a more or less severe grade of infectious catarrh of the upper air-passages, and that the mucous membrane of the posterior wall of the larynx is in a state of morbid excitability, which, under slight stimuli, mechanical or even nervous in character, provokes the reflex spasmodic action of the expiratory muscles concerned in producing the characteristic paroxysms of the disease.

While so much has been accomplished in elucidating the pathology of per-

[1] *Deutsches Archiv f. klin. Medicin*, 1887.

tussis, the more important question of its treatment has been but little modified by newer methods. A host of new remedies, mostly addressed to the microbic nature of the disease, have found enthusiastic advocates among recent observers, the list including almost every antiseptic drug in the Pharmacopeia. Many of these drugs have shared the fate of the multitude of older remedies now almost forgotten; many have failed to stand the test of wider use under more varied conditions; while some few have really proved of distinct value, and may with advantage be added to the list of available remedies. The common experience of physicians shows that whooping-cough is a disease of very variable severity and duration. Many cases, especially in the lower walks of society, pursue their course without great severity and recover without any treatment whatsoever. In such cases almost any drug would yield brilliant results, and thus, there can be little doubt, the reputation of many heralded methods of treatment has been acquired. Even to-day the result of a candid study of the therapeutics of this disease forces us to confess that pathology has developed no specific treatment for pertussis, any more than intestinal antisepsis has furnished the key to the treatment of typhoid fever. As in the latter disease, much may be done to modify the severity of its course, guard against accidents, and support the strength and nutrition of the patient, but beyond this it cannot truthfully be said that our treatment differs, except in detail, from that outlined by the writers of twenty or thirty years ago.

**Prophylaxis.**—Dolan very sagely remarked that if upon a certain day all the children suffering from whooping-cough could be isolated and quarantined for a lengthened period, the disease could be stamped out; and while, with him, we may recognize the impracticability of such a plan, the principle that it embodies lies at the foundation of all preventive medicine and points out a line of duty to those whose daily practice brings them in contact with this really dangerous and often fatal disease of childhood. It is therefore highly important, when a case of pertussis is first declared, to remove it from the vicinity of other children liable to contract the disease, and to establish a rigid quarantine, to prevent all unprotected children from coming into the presence of the affected child. The contagium of pertussis is very active, and even a momentary exposure to the atmosphere surrounding a patient has been known to communicate the disease. Fomites are also capable of carrying the contagion, though its spread by the mediation of an unaffected individual, unless a parent or a nurse who is in constant contact with the sick child, is rarely observed. Steffen states that he has never encountered such a mode of transmission.

Until our knowledge of the life-history of Afanassiew's bacillus is complete, it is prudent to consider all articles of clothing, excreta, vessels, and personal belongings of the patient as capable of spreading the disease. Until the public can be impressed with the importance of this fact, and of the individual duty incumbent upon every citizen unselfishly to aid in controlling the dissemination of this disease, whooping-cough will maintain its position as one of the most common and most serious diseases of infancy and childhood. Articles of

clothing used about the child, if unsuitable for disinfection by steam, should be submitted to the fumes of sulphurous acid, or, better still, should be burned. Table-utensils should be thoroughly scalded and washed in strong solutions of carbolic acid, chlorinated lime, or other reliable disinfectant; and bed-linen should first be soaked in a disinfectant solution and then boiled. During the prevalence of an epidemic the greatest care in domestic hygiene is imperative for those still uninfected. Cleanliness, pure air, sunlight in the house, and a proper diet for the children are all important factors in discouraging the spread of the contagion; but it is from without—in the schools and kindergartens, in public conveyances, and in places of promiscuous assemblage—that the germs of whooping-cough are introduced.

The insidious onset of the disease gives ample opportunity for the infection of all susceptible children in a family long before the parent, or even the physician, may suspect the true nature of the supposed "cold;" and when one child of a family begins to whoop, it is useless to remove from the house the other children that have been its constant companions. Even if such children show no evidence of the disease at the time, it is almost certain to declare itself shortly after their removal to a new locality, and the change will simply have resulted in the creation of a new focus of infection. When, however, the disease has not thus gained access to a household, and we have reason to dread the infection of a delicate child or one that has but imperfectly recovered from the effects of a debilitating sickness, prudence would indicate its careful separation from other children of the family whose daily life at school may bring them in contact with the disease—a separation carried to the extent even of a sojourn at some distant sea-shore or country resort, where, too, perfect health may be more rapidly regained.

The length of time during which isolation should be maintained is somewhat uncertain. Ollivier believes a child should not be allowed to return to school for three weeks after the characteristic paroxysms have ceased. When the duration of the spasmodic stage is not unusually long—for example, not greater than two months—this rule offers a satisfactory guide; but there are many cases in which the child apparently completely recovers for a short time and then begins to whoop again, and not infrequently a whoop-like cough may recur at intervals for several months, especially in children whose nervous system and general nutrition have been affected greatly by the disease. In these cases the cough cannot be considered as a return or a relapse of the disease, but is rather a cough of "habit;" a fresh irritation of the larynx or trachea pursuing the accustomed reflex are made familiar by the disease that has but recently passed away. Here the risk of infection from the patient may be considered as practically *nil* after an interval of two months from the onset of the paroxysmal stage in the shorter cases, or of three months in the longer.

**Hygiene.**—Pure air is of supreme importance to the sufferer from whooping-cough. The sleeping-room must be most thoroughly ventilated, while at the same time drafts should be avoided and care be taken to prevent exposure during sleep by using night-clothing that will completely cover the lower limbs.

Jürgens advises that the child's sleeping-room should be changed every five days, and Séjournet requires two rooms, one to be used by day, the other at night. When practicable, the latter plan may advantageously be adopted, and it may be supplemented by fumigation of the room vacated with the vapor of burning sulphur, according to the method suggested by Mohn (p. 128).

For use by day, a complete set of woollen underclothing, woollen stockings, and stout shoes should constitute the dress, even for wear in the house. In winter the temperature of the room should be kept at a fixed point, not exceeding 68° F. (20° C.). Even in cold weather, after the early febrile symptoms have subsided, and provided no pulmonary complications exist, exercise in the open air may be permitted robust children when the atmosphere is dry and still. While such patients may have more paroxysms while out, they sleep better at night and maintain a higher grade of general nutrition than when confined to the house. Under no circumstances, however, should the child be allowed to run and play at will, associating with other children or over-exerting itself; it must be carried in the nurse's arms or forced to walk sedately at her side. It is a mistake, also, to give indiscriminate permission for exercise in the open air. The irritable and inflamed respiratory mucous membrane in this disease is always more susceptible to changes of temperature and to damp, cold winds than normal membrane, so that the mother should be warned that a simple case may thus easily be converted into a serious one by injudicious exposure to improper atmospheric conditions.

The diet is a most important consideration. It is not alone sufficient to see that the food is nutritious and easily digestible and proper in amount. The frequent attacks of vomiting cause the loss of much of the nourishment that the child has already ingested, and it is therefore important that food should be given at frequent, regular intervals, in correspondingly small quantities, and that when vomiting occurs shortly after the ingestion of food, the loss should at once be made good by a fresh supply. Bread and milk, custards, broths, and milk are the chief articles of diet to be chosen, with a little minced mutton or chicken, and other light food for occasional variety. When the stomach is especially irritable, lime-water or sodium bicarbonate should be given with the milk; peptonized foods or liquid peptonoids may offer temporary substitutes, and in appropriate cases feeding by the rectum may for a time be employed advantageously.

**Systemic Treatment.**—It will be impossible in the scope of this section to consider all the methods of treatment now in vogue, but an effort will be made to outline the conduct of the case through its several stages, leaving for a special section a necessarily brief consideration, by way of appendix, of the numerous drugs that have recently been brought forward with more or less convincing claims of efficacy in this disease.

As a rule, whooping-cough begins insidiously as a slight catarrh, which at first improves under the customary nursery treatment and confinement to the house for a day or two; but as the child again resumes its usual habits the cough returns in a more aggravated degree and becomes especially annoying at

night—a significant symptom that should put one on guard. It is rare, however, that the case comes under observation at this period, and it is not until the persistent aggravation of the symptoms or the actual occurrence of the whoop that the nature of the disease is suspected and medical treatment is sought. In some instances, however, the onset is more severe, and marked bronchitis with febrile disturbance may demand relief. Under these circumstances a mustard foot-bath followed by cooling aperients and salines, with a fever-mixture containing fractional doses of tincture of aconite, solution of potassium citrate, and wine or syrup of ipecacuanha may be directed; for example:

℞ Tinct. aconiti, ♏ij (0.12);
Vini ipecacuanhæ, ♏xlviij (3.);
Syrup. aurantii florum, f℥ss (15.);
Liquor. potassii citratis, q.s ad f℥ij (60.).—M.
S. A teaspoonful every two hours for a child of two years.

If the febrile symptoms continue and the bowels are not freely opened, a few grains of magnesium sulphate may be added to each dose of this mixture, or fractional doses of calomel may be given hourly till a free evacuation is secured. At this period, sometimes, the fever and prostration are marked, the lungs are found to be full of coarse bronchial râles, and the respiration is short, quick, and catching; while drowsiness, interrupted only by a fit of coughing or vomiting, with heavy, somewhat puffy face and swollen, purplish lips, gives evidence of increasing cerebral congestion. Under these circumstances much benefit may be obtained by applying one or more leeches to the temple or back of the ears, and by thoroughly evacuating the bowels with a grain (0.065) of calomel followed by a rapidly acting saline purge. At this stage sedatives, especially opium, should be used with extreme caution, lest they add to the danger by masking the urgency of the symptoms. Violent attacks of cough and copious expectoration attest the severity of the bronchial inflammation; and when to these are added a relaxed and sweating skin, cyanosis, and drowsiness, there is urgent need of general stimulation by means of cardiac tonics and stimulating expectorants—alcohol, quinin, nux vomica, digitalis, and ammonium carbonate or ammonium chlorid.

As the fever diminishes and the severity of the bronchial inflammation subsides, the disease passes from the invasive stage; and with the occurrence of the characteristic whoop the spasmodic stage may be said to be fairly inaugurated. The indications for treatment are now clearly manifest: first, to relieve or cut short the paroxysm; second, to subdue the irritability of the respiratory mucous membrane and of the general nervous system; and third, to relieve the overloaded bronchial tree of accumulated secretion.

During a paroxysm the child should be made to sit down or kneel, and the head should be held in the mother's hands. With very young children, at the end of a coughing-spell the accumulated mucus should be removed with the finger

or collected with a feather, or a brush may be swept over the palate, the uvula, and the nasal fossæ to provoke expulsion by vomiting or sneezing. Laënnec recommended the administration of a few swallows of cold water, the movements of deglutition thus provoked rendering inspiration easier and deeper. If the paroxysm be very severe and asphyxia is threatened, the body should be beaten with a soft towel, or cold water should be sprinkled upon the chest; revulsives may also be applied to the lower limbs, and even a full warm bath will be of service, while ether can be given hypodermically. In case of syncope or apparent death, artificial respiration should be kept up as long as necessary, and electrization of the phrenic nerve, as suggested by Baumel, may be resorted to. The antispasmodic effect of atropin, as well as its power as a respiratory stimulant, should not be forgotten in such an emergency. Inhalations of ether or of chloroform may be required to relieve a long-continued paroxysm.

*Antispasmodics.*—Of all antispasmodic drugs there is probably none of more generally conceded value than *belladonna.* Under its use the frequency and severity of the paroxysms are markedly allayed. According to some authorities, among whom Trousseau may be mentioned, belladonna should be administered in moderate dose; others, like Jacobi, prefer to push it to its full physiologic effect, not being satisfied until an erythematous flush of the cheeks is induced in from fifteen to thirty minutes after each dose. Trousseau employed the following formula:

Pulvis belladonnæ,
Extracti opii aq., āā gr. iv (0.26);
Extracti valerianæ, ʒss (2.).—M.
Divide in pilulas No. xvj.
S. From one to four in the course of a day.

Jacobi begins, in the case of a child of six years, for instance, with a dose of 10 drops of the tincture of belladonna (U. S. P.) three times a day; and if flushing is not produced, or if, as usually happens, it is produced after the first few doses, and then ceases, he increases the dose till flushing again occurs, maintaining that otherwise the drug will have no effect. Day[1] usually begins with gr. $\frac{1}{4}$ (0.016) of the extract of belladonna for a child of two years, given in glycerin or in sirup of tolu every four hours; if this has no effect upon the paroxysms, the same dose is given every two hours until it makes an impression. Fuller[2] obtained satisfactory results from combining zinc sulphate with belladonna. As soon as the whooping began he directed to be given, every third or fourth hour, a draft containing a grain (0.065) of zinc sulphate and gr. $\frac{1}{6}$ (0.011) of extract of belladonna, 2 fluidrams (8.) of sirup of orange, and from 2 to 6 fluidrams (8.–24.) of water; an additional grain (0.065) of zinc sulphate and gr. $\frac{1}{6}$ (0.011) of extract of belladonna were added to each dose daily or every second day until the daily quantity amounted to

[1] *Diseases of Children.*

[2] *Diseases of the Lungs,* 1867, p. 384.

from 6 grains to a dram of zinc (0.39–4.) and from 2 to 6 grains (0.13–0.39) of extract of belladonna. To children under twelve months of age he never administered more than 10 grains (0.65) of zinc and 2 grains (0.13) of belladonna daily. Belladonna is well borne by children, but it seems doubtful, as Steffen has pointed out, if such heavy and necessarily long-continued dosing with so powerful a drug is justifiable, inasmuch as the course of the disease is not materially shortened, although the severity and number of the paroxysms are decreased. Meigs and Pepper advised a dose of the extract of belladonna not exceeding gr. $\frac{1}{24}$ (0.0027) every four hours for a child of one year, usually combined with alum (formula, p. 125).

*Atropin sulphate* may be given by the mouth in place of the extract of belladonna, as advised by Evans,[1] or hypodermically, as suggested by Lee.[2] Kroon prefers the valerianate of the alkaloid. The initial dose of either salt should not exceed gr. $\frac{1}{120}$ (0.00054).

Another drug of the same class as belladonna is *cannabis indica*, which may be given three or four times a day in doses of one drop of the tincture for each year of age. *Opium*, with its alkaloids, morphin, codein, and narcein, is also a valuable drug for its sedative and anodyne effects when the cough is especially frequent and interferes with sleep at night. As an occasional remedy, given at bed-time, it may be recommended, but as a routine plan of treatment its use is to be deprecated. The same may be said of *hydrocyanic acid* and *zinc cyanid*—drugs that have been highly praised by some practitioners, but which are undesirable for continuous use on account of their poisonous character.

*Conium* was formerly employed quite extensively in the treatment of whooping-cough, especially as an ingredient of mixtures containing other remedies. It is now little used, being certainly less efficacious than belladonna.

Of other drugs distinctly antispasmodic in character, chloral and the bromids demand some notice. *Ammonium bromid* has been recommended, especially by Harley and Gibb, as possessing a local sedative and anesthetic effect upon the mucous membrane of the pharynx and the larynx. It may be added to the treatment with decided benefit when the paroxysms are severe —from gr. $\frac{3}{4}$ (0.049) to 3 or 4 grains (0.19–0.26), according to age, three or four times a day. Ringer, Helenke, Erlenmeyer, and Fallami have preferred *potassium bromid*, and Field the *sodium* salt. There is probably little choice between the latter two.

*Chloral*, according to Heubner,[3] tends distinctly to relieve the paroxysms, and its soporific action may be advantageously availed of when the nocturnal paroxysms are very annoying and greatly disturb the child's rest. Actual or threatened convulsion will demand this drug, which may then be combined with one of the bromids, other medication addressed to the disease being for the time suspended.

[1] *Glasgow Medical Journal*, 1880. [2] *N. Y. Medical Journal*, 1883.
[3] *Jahrbuch f. Kinderheilkunde*, Bd. xvi. S. 388.

Many of the other milder antispasmodics, like musk, camphor, valerian, zinc valerianate, castor, and asafetida, have been recommended by various writers, and in mild cases they may be of some service, but their use is limited.

*Specifics.*—Another class of remedies includes those to which is ascribed more or less specific action upon the disease. Among the most important of these is *alum*, which was first brought into general notice by Golding-Bird.[1] This authority recommended the drug highly in the second stage, when the profuseness of bronchial secretion acted as a frequent exciter of the paroxysm. Meigs and Pepper,[2] who speak most highly of the action of alum, consider that it exerts a more decided influence in moderating the violence of the disorder than any remedy they have made use of. These observers claim for alum in combination with belladonna better results than from any single remedy. To children under one year from ½ grain to 1 grain (0.032–0.065) of alum is given three or four times a day; to older children, 2 grains (0.13) every four or six hours. For a child of one year the following formula is recommended:

℞ Ext. belladonnæ, gr. j (0.065);
Aluminis, ʒss (2.);
Syrup. zingiberis,
Syrup. acaciæ,
Aquæ, āā fʒj (30.).—M.

S. A teaspoonful four times in twenty-four hours—in the morning, at noon, at bed-time, and once during the night if the cough is troublesome.

*Potassium carbonate* was at one time extensively used in Philadelphia, and even abroad, where it received the support of Niemeyer. The dose was a grain (0.065) three or four times a day for a child of from one to two years of age.

*Peruvian bark*, or its alkaloid, *quinin*, would naturally suggest itself as a tonic during the second and third stages of the disease, and as such we find it used by Rosen, Cullen, Hufeland, and others. In 1870, Binz[3] claimed that quinin, in sufficiently large doses, if given in solution, so as to come in contact with the mucous membrane of the pharynx, exerts a specific action in whooping-cough, and in 1873, Dawson[4] confirmed this view. Since then considerable testimony has been brought forward in favor of this drug by Steffen, Raymond, Ungar, Breidenbach, and many others. The hydrochlorate or the sulphate should be given, preferably suspended in simple sirup, sirup of yerba santa, or with licorice or chocolate, or by rectal suppository. The dose should be comparatively large—from 10 to 24 grains (0.65–1.55) daily according to age, and increased according to tolerance. It will not infrequently happen, however, whether from repeated vomiting or from positive rebellion on the part of the little patient, that a sufficient dose of the drug cannot be given by

[1] *Guy's Hospital Reports*, April, 1845. [2] *A Practical Treatise on the Diseases of Children.*
[3] *American Journal of Obstetrics and Diseases of Women*, iii. [4] *Ibid.*, 1873.

the mouth, while rectal medication causes too much irritation. Under these conditions the hypodermic use of the dihydrochlorate of the alkaloid, which Laubinger[1] has recently advocated, may be advantageously practised. This salt is quite soluble in water, and, provided the solution be aseptic, can be injected repeatedly beneath the skin without causing abscess. Looking at the accepted etiology of the affection, it would seem that better results might be expected from a topical application of the drug to the naso-pharynx; this use will be referred to hereafter.

*Sulphur* has long enjoyed a reputation in whooping-cough, especially in Germany, where it has been given in doses of 2 or 3 grains (0.13–0.19) several times daily, suspended in milk or in sirup. In the form of sulphurous-acid vapor its use will be referred to under local remedies.

Dilute *nitric acid* (recommended especially by Arnoldi of Montreal and praised by Gibb) and *hydrochloric acid* may be mentioned without much comment. The latter acid may be of service as a general tonic and alterative to the digestive tract, and this action alone is probably responsible for all the benefit that can be attributed to its use.

*Antipyrin*, recommended in 1887 by Sonnenberger,[2] seems to be one of the most valuable remedies of recent introduction. Under its use the severity of the paroxysms is usually distinctly modified, the cough is lessened, and the duration of the disease is somewhat shortened. The average dose, to be given three or four times daily, is stated by Sonnenberger to be as many centigrams (gr. $\frac{1}{6}$) as the age numbers months, or decigrams (gr. $1\frac{1}{2}$) as the age numbers years, and this dose may gradually be increased. The dose for larger children and for adults is from $7\frac{1}{2}$ to 15 grains (0.5–1.) thrice daily. The drug acts best when its administration is begun early in the course of the disease.

*Phenacetin and acetanilid* have also been tried, but they are much less constant in results than antipyrin, and are not generally employed.

*Emetics.*—Custom has long sanctioned the more or less active employment of emetics during the paroxysmal stage of pertussis; and there can be no doubt that when the mucus is ropy and tenacious, and the paroxysms are severe and frequent, judicious administration of an emetic will greatly relieve the endangered lung. Copeland recommended an emetic every third day in ordinary cases, but this is rarely necessary as a routine treatment, and may often do more harm than good, especially when the spells of vomiting are frequent. When, however, such a drug seems indicated, one of the milder emetics should be chosen, preference being given to *ipecacuanha*, though *alum* or *zinc sulphate* or *copper sulphate* may be employed. On account of its depressing effects, *tartar emetic* should never be used. Better results may often be obtained by giving only enough of the emetic to produce a slight nauseating effect; to a child of three years from 10 to 20 drops of sirup of ipecacuanha three times a day will usually be sufficient to meet this indication.

*Cardiac Tonics.*—The consideration of the systemic treatment of the second

[1] *Jahrbuch f. Kinderheilkunde*, Bd. xxxix. S. 141.

[2] *Deutsche medicinische Wochenschrift*, 1887, 14.

stage cannot be dismissed without reference to the importance of a careful study of the heart. In a very thoughtful paper, Koplik[1] calls attention to the great danger of heart-strain in every case of pertussis. The first indication of strain, he points out, "is the slight edema about the eyelids and the face, so well known to all of us. In more severe cases the venous stasis and the edema are followed by cyanosis of the mucous membranes. It is in this condition that we mostly obtain the petechial and other hemorrhages during a paroxysm, for hemorrhages do not occur when the heart is still strong." *Digitalis* is therefore prescribed by Koplik as soon as the first indications of heart-strain are noticed. A minim (0.062) of the tincture for each year up to the second, and then half a minim (0.031) additional, every two or three hours as indicated, is about the usual dosage. There can be no doubt that this procedure is founded upon rational physiologic grounds and is most important.

**Local Treatment.**—Even before the microbic nature of whooping-cough was seriously thought of, we find experimental therapeutists looking to the upper respiratory passages as an advantageous ground for combating the morbid activities of this disease. In 1849, Ebenezer Watson[2] tried to control the paroxysms by touching the larynx during the free intervals with a solution of *silver nitrate*—necessarily an imperfect method, as the drug could only reach the supraglottic region. But seventeen years later, Rehn employed the same drug by atomized inhalation, with satisfactory results, and since then very many different methods of local treatment have been advocated. For purposes of convenience we may consider local treatment under the following headings—1. Inhalations of volatile substances and gases; 2. Applications of solutions by atomization, brush, or irrigation; and 3. Insufflation of medicated powders into the nasal passages or the larynx.

1. *Inhalations.*—Various vapors or gases have from time to time enjoyed an ephemeral popularity. Clar praised the vapor of *camphor* and *oil of turpentine*, and Kjellberg advised *benzine*. Desmartes obtained favorable results by exposing patients to the vapors of the purifying chambers of gas-works. His example was extensively followed by Commenge[3] and Bertolles,[4] in France, though the practice was condemned by Maingault, Bergeron, Barthez, and Bouchut. The experiment was tried in Philadelphia at about the same time, with varying but somewhat satisfactory results.

In 1874, Burchardt[5] recommended inhalation of steam from a $1\frac{1}{2}$ to 2 per cent. solution of *carbolic acid*. This drug is still employed, notably by J. Lewis Smith of New York. The same effect may be obtained by exposing the child to an atmosphere impregnated with this drug by evaporation from flannels or other fabric saturated with its solution, or by evaporating a few crystals from time to time by dropping them upon hot coals, or, as Pick advises, by inhalation from a respirator. Wilde[6] praised a mixture of *turpentine*,

[1] *Transactions of the American Pediatric Society*, 1893.
[2] *Edinburgh Monthly Journal*, Dec., 1849.
[3] *Bull. de l'Acad. Roy.*, xxx. p. 9, 1864.
[4] *British Medical Journal*, Nov. 5, 1864.
[5] *Deutsche Klinik*, 41, 1874.
[6] *Deutsches Archiv f. klin. Med.*, vol. xiv. part 2.

*chloroform*, and *ether* for inhalation. Ivanoff[1] reported excellent results from inhalation of the vapor of *naphthalin* contained in a linen bag suspended around the child's neck. The powder should also be sprinkled freely upon the floor. *Cresolin* is another coal-tar product at present in vogue. It is vaporized in the room by heating over a spirit-lamp. Bouchut[2] keeps suspended in an earthen or metallic cup over a night-lamp a mixture of 10 parts of *thymol*, 250 parts of alcohol, and 750 parts of water. By the slow evaporation of this liquid an antiseptic atmosphere is constantly maintained in the room.

Hardwicke[3] prefers *oil of eucalyptus* to carbolic acid as being three times as strong a germicide, without the inconveniences of the latter. He combines oil of eucalyptus with oil of turpentine, using equal parts of each to eight times as much of rectified spirit. Inhalations of this mixture are given half an hour before each meal and at bed-time. Aubret advises that the pillow be sprinkled with powdered *iodoform*.

Mohn[4] cited very rapid cures from subjecting the living-room and the clothing to the vapors of *sulphurous acid*. Sulphur, in the proportion of 25 grams to every cubic meter of air-space (10 grains to the cubic foot), is burned in the sleeping-room, which is then kept sealed for five hours. After this the windows and the doors are thrown open, and the room is occupied that night. The same process of purification may be employed also for the day-room, so that the child is constantly kept in an atmosphere of diluted sulphurous acid. Improvement is said to be rapid, the cough being lessened, expectoration facilitated, and the paroxysms diminished. Manby[5] states that he has seen most remarkable results from this plan of treatment, and his testimony is confirmed by that of Schönberg, Kaurin, Schliep, Féréol, and others. Weisgerber[6] goes so far as to subject the child twice a day for an hour to the fumes of burning sulphur, using 10 grams of sulphur to a chamber containing eighteen cubic meters of space. The treatment is said not to be very objectionable, and satisfactory results have been obtained in bad cases. Dujardin-Beaumetz[7] also speaks highly of this mode of treatment.

Essential *cypress-oil* is used by Bravo,[8] who drops it upon the clothing near the neck or upon the pillow, so that a constant inhalation of the volatile principle is secured. The results are said to be rapidly successful.

2. *Application of Solutions.*—Since Watson's experiment with solution of silver nitrate, many substances have been recommended for local use in solution, by atomization, swabbing, syringing, or gargling. *Carbolic acid* in spray has been used by Gerhardt, Burchardt, Thorner, Davezac, and others, the solution varying in strength from 1 : 500 to 1 : 50. *Resorcin* was first proposed as a local remedy in 1883 by Moncorvo of Brazil. He applied a 1 per cent. solution of the drug by brush to the glottis and the perilaryngeal region,

[1] *Vratch*, 1891, No. 48, p. 1094.
[2] *Paris Médical*, 1883.
[3] *Lancet*, No. 2, 1889.
[4] *Norsk Magazin for Laegeridenskaben*, Nov., 1886.
[5] *Practitioner*, London, 1888, v. 41, p. 120.
[6] *Bulletin gén. de Thérap.*, 1890, cxviii. 367.
[7] *Bulletin de Thérap.*, April, 1890.
[8] *Rivista med. de Chile*, No. 7, 1891; *British Medical Journal*, Oct. 17, 1891.

repeating the application every two or three hours day and night, according to the severity of the case. Even in grave cases he succeeded in obtaining recovery in from three weeks to a month. The drug was supposed to destroy the germs in the pharynx and the larynx. The plan has received the support of numerous observers, but it entails the almost constant presence of a skilled attendant. Farlow[1] has improved the method by spraying the nose, the larynx, and the pharynx with a 2 per cent. solution of the drug every two hours; he claims very speedy relief.

Pott of Halle[2] has obtained striking success by painting the throat with from a 5 to a 10 per cent. solution of *cocain* two or three times a day; but the drug is a dangerous one, and even in much weaker solution has produced alarming symptoms. It should never be used by atomization. Illingworth[3] applies *tannin glycerite* to the larynx two or three times a day, in combination with internal treatment. Bleyer[4] praises highly *hydrogen dioxid*, which was proposed by Adams and Richardson. He sprays the larynx with a 1 : 5 solution of the 15-volume strength, and then irrigates the nares with a 2 : 3 solution of the same strength. Irrigation with other solutions has been proposed: for example, Goldschmidt[5] uses *salicylic acid*, 1 : 1000, or *corrosive sublimate*, 1 : 10,000, every two hours for the first day, then every three hours. Various other drugs have been used in one or other of these ways, but the list need not be further prolonged.

3. *Insufflation of Powders.*—Letzerich,[6] believing that whooping-cough is due to a fungus, recommended in 1873[7] the insufflation into the larynx twice daily of *quinin hydrochlorate* in combination with sodium bicarbonate and gum arabic, in the proportion of from 1 to 1½ parts of the hydrochlorate to 1½ parts and 25 parts respectively of the other drugs. This plan has been followed extensively and has given very satisfactory results. Forchheimer[8] has modified this treatment by increasing the proportion of quinin, which is the active ingredient. He uses 1 gram (15 gr.) of quinin to ½ gram (7.5 gr.) each of sodium bicarbonate and acacia, and blows this quantity twice daily into the throat. He reports 97 cases treated solely by this method, the maximum duration being twenty-one days, the average about twelve days. Almost, if not quite, as favorable results have been obtained from nasal insufflations; this method of local treatment can be carried on by the child's attendants. *Boric acid*, powdered *benzoin*, *quinin*, and *tannic acid* have been thus employed.

Michael[9] thinks that he has shortened the duration of the disease by insufflations of powdered *benzoin*, reporting prompt improvement in 43 out of 55 cases. Guerder used *boric acid* and *coffee*, from which treatment Halloway[10] reports very satisfactory results. D'Heilly and Moizard[11] employ *bismuth*

[1] *Therapeutic Gazette*, April 15, 1890.
[2] *Jahrbuch für Kinderheilkunde*, 1886, B. xxiv. S. 73. [3] *Lancet*, April, 1885.
[4] *Omaha Clinic*, Oct., 1889; *Annual of the Universal Medical Sciences*, 1890.
[5] *Deutsche medizinal Zeitung*, July 30, 1885. [6] *Virchow's Archiv*, vol. 49, 1870.
[7] *Ibid.*, vol. 57. [8] *American Journal of Obstetrics*, 1882, p. 220.
[9] *Archiv für Kinderheilk.*, viii. 2, p. 99. [10] *British Medical Journal*, 1887, vol. ii. p. 827.
[11] *Pratique des Maladies des Enfants dans les Hôpitaux de Paris*, 1893.

*salicylate* 5 parts, benzoin 5 parts, and quinin sulphate 1 part, repeating the insufflation five times daily.

Schwartz[1] claims extraordinary success from insufflation of a powder composed of equal parts of *charcoal, sulphur, myrobalan,*[2] and *sodic sozoiodolate,* giving daily one insufflation of from 4½ to 5 grains (0.29–0.32). All of his cases (57) during a period of two months are reported to have gotten well in from three to six days. Results almost equally as good are said to have been obtained in the clinics of Guttmann in Berlin and Monti in Vienna.

Finally, Marfan[3] uses an ointment consisting of 6 parts of *boric acid,* 5 parts of *menthol,* and 30 parts of vaselin, a portion the size of a pea being introduced into each nostril three or four times daily after cleansing. At the same time internal treatment is pursued.

**Treatment of the Stage of Decline.**—After a varying period of activity the spasmodic stage of pertussis gradually merges into the concluding stage, that of decline. The paroxysms become less frequent and less severe, and vomiting occurs more and more rarely, till the symptoms of an ordinary bronchitis replace the characteristic phenomena of whooping-cough. In addition to appropriate treatment of the bronchitis, the indications are simple: *ferruginous tonics* to correct the resulting anemia; cod-liver oil and hypophosphites as general tonics and reconstructants. In very young children, and especially in infants that are artificially fed, the digestive functions will be found considerably below par. Under these circumstances much may be accomplished in securing a speedy return to health by careful regulation of the diet, and at the same time aiding the digestion by bitter tonics, pepsin, and mineral acids. It is in this declining stage of the disease that a change of air, preferably to that of the sea-coast, will wonderfully shorten convalescence and hasten a return of health.

**Treatment of the Complications.**—Of the ordinary complications of whooping-cough the treatment must in general be such as would be appropriate to the complicating disease under the usual conditions—always, however, with the fact in mind that the original disease is still present and will remain after the complicating condition has passed away. Care must therefore be exercised to employ no exhausting or irritating remedies, and the nutrition of the patient must be kept up by all possible means. In this connection a word of caution may be said in regard to the continuance of such depressing drugs as chloral and antipyrin, or even belladonna, after the development of a serious inflammatory complication. In the presence of broncho-pneumonia or serious bronchitis the peculiar whoop almost or quite disappears for the time, so that constitutional treatment of the pertussis may often with advantage be suspended temporarily while the more pressing complication is being cared for.

[1] *Jahrbuch für Kinderheilk.*, xxxvi. S. 482.

[2] Myrobalan is no longer in the European pharmacopeias. It can be obtained as "coelyt" from Tromsdorff in Erfurt.

[3] *Pratique des Maladies des Enfants dans les Hôpitaux de Paris,* 1893.

*Ulceration of the frœnum linguæ* will need nothing but occasional stimulation with a weak solution of silver nitrate or a touch of the silver stick, a cleansing and antiseptic mouth-wash being used to guard against infection of the wound.

*Bronchitis* occurring in the course of the second stage is best controlled by confining the child to bed, giving a mustard foot-bath, to be repeated daily or more frequently, counter-irritating the chest, and administering sirup of ipecacuanha, sweet spirit of niter, and potassium citrate or potassium acetate in combination. If the bronchial secretion be profuse, a stimulating expectorant like senega or an occasional emetic may be added, with small doses of paregoric to quiet excessive cough.

*Broncho-pneumonia* and *convulsions*, the most serious and fatal complications of the disease, are to be treated in accordance with the principles detailed elsewhere.

*Hemorrhages* from the nose, the mouth, or the lungs are most commonly encountered in neglected cases, and are rarely severe enough to be a source of danger. Epistaxis is the most common, and can usually be controlled by mitigating the severity of the paroxysms and strengthening the heart. Nasal insufflation of a powder containing tannic acid will be of service.

It occasionally happens that another infectious disease, such as *measles* or *scarlatina*, appears during the course of whooping-cough. In this event the pre-existing disease seems usually to be so modified by the poison of the second infection that its course is more speedily brought to a close. A similar effect has also been noted with regard to *vaccinia*, and it has been proposed to employ vaccination as a means of treatment for pertussis. Attilio[1] states that of 52 cases he has cured two-thirds by vaccination, while in the others he secured notable amelioration. This effect is said to be obtainable whether the inoculation is made in the first or in the second stage.

**Appendix of Newer Drugs.**—One of the most recent of the new drugs, and probably the most important, is *bromoform*, recommended in 1889 by Stepp of Nürnberg.[2] Bromoform is a colorless oily liquid produced by the action of bromin upon alcohol in the presence of an alkali. It should be kept in a dark bottle, as exposure to light liberates bromin and renders the drug unfit for use. The dose for a child aged from six to twelve months is 2 drops three or four times a day; from one to two years, 3 drops; from two to four years, from 4 to 5 drops; and the dose may gradually be increased until it is doubled. The drug is best given floating in a small teaspoonful of water. Much testimony has been given in its favor by Stepp, Löwenthal, Schippers, Burton-Fanning, and Fischer of New York. It is said to act satisfactorily whether its administration is begun early or later in the convulsive stage. Löwenthal[3] states that beneficial effects are sometimes noted on the second day, but oftener on the third or the fourth day, depending upon the

[1] *Archivio Italiano di Pediatria*, 1893, Nos. 1, 2, 3.

[2] *Deutsche medicinische Wochenschrift*, 1889, 31 and 44.

[3] *Berliner klinische Wochenschrift*, 1890, No. 23, p. 508.

severity of the cough; vomiting is usually stopped in the first week, and the disease is cured in from two to four weeks. Other observers have not been so successful with this drug, but the very high testimony in its favor warrants its further trial.

*Carbolic acid* internally, a tablespoonful of a 1 : 120 solution three or four times a day, has been proposed by Oltramare.

*Pilocarpin* was employed by Albrecht[1] in ten cases in children between one and a half and nine years of age, with asserted good results.

*Resorcin* internally has been advocated by Concetti[2] in dose of from 3 to 22 grains (0.19–1.43) according to age.

*Ouäbain* has been highly praised by Gemmell,[3] who has found it of marked benefit in all stages of the disease. It should be given in doses not larger than gr. $\frac{1}{1000}$ (0.000065) every three hours, and to children under one year of age the dose must not exceed gr. $\frac{1}{2000}$ (0.000032). To older children, if the paroxysms are numerous, gr. $\frac{1}{500}$ (0.00013) may be given at a dose, the effect being watched carefully. The drug is an anesthetic and exerts a powerful depressing effect upon the respiration. Its use in whooping-cough has not received general acceptation.

*Gold and sodium chlorid* has been employed successfully by Magruder[4] in doses of gr. $\frac{1}{48}$ (0.0014) every two hours in a case in which all ordinary remedies had failed. Rachel[5] has also used this drug, alone or in combination with opium, with satisfactory results.

*Chloroform*, originally suggested in 1860 by Roger, has been again advocated by Schilling,[6] who adds to a tablespoonful of water in a vaporizer twice as many drops as the child numbers years, and causes the patient to inhale the vapor four times daily. The violence and frequency of the attacks are diminished, and the convulsive stage is said to be usually shortened to four weeks at the most.

*Antispasmin*, a combination of one molecule of sodium-narcein and three molecules of sodium salicylate, has been quite recently brought forward by Frühwald,[7] who reports very encouraging results in a large number of cases.

The list might be considerably prolonged to cover the literature of recent years, but it is believed that all the drugs of importance have been duly noticed.

**Resume.**—In conclusion, I may state that personally I have obtained most satisfactory results from a mixture of alum and belladonna (aluminis, gr. j (0.065); ext. belladonnæ, gr. $\frac{1}{48}$ (0.0014); sirup of ginger and water, equal parts; given every two hours, to a child one year old). If the paroxysms are very severe, 1 or 2 grains (0.065–0.13) of ammonium bromid may be added and given at the same interval. Antipyrin is also of service under these circumstances, and chloral when the sleep is greatly disturbed. Nitro-hydrochloric

[1] *London Medical Record*, March 15, 1882.
[2] *Arch. Ital. di Pediat.*, 1889, vii. 124–132.
[3] *British Medical Journal*, April 26, 1890.
[4] *American Journal of Obstetrics*, Feb., 1885.
[5] *Archives of Pediatrics*, March, 1889.
[6] *Bulletin de Thérap.*, July 25, 1890.
[7] *Archiv f. Kinderheilkunde*, Bd. xviii. S. 38.

acid and quinin should be given as tonics during the whole course of the disease. Locally, for nasal insufflation, a small portion of a powder consisting of cocain hydrochlorate 1 grain (0.065), boric acid 15 grains (1.) and bismuth subnitrate sufficient to make a dram (4.), may be advantageously employed two or three times daily. Tincture of digitalis is very valuable when the heart shows the effects of right-sided engorgement, and its administration under these circumstances should never be neglected.

# INFLUENZA.

By I. E. ATKINSON.

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There is no specific treatment for influenza. Not only do different epidemics vary in general type, but in a given epidemic certain symptoms or groups of symptoms often acquire special prominence and exert marked influence upon the course of the disorder. Moreover, while the clinical history of influenza may be pretty clearly defined, given cases vary so widely in predominating features, in the complications that arise, and in the results that follow, that a systematic exposition of the treatment of the disease becomes impossible. Fortunately, however, it is quite possible to speak definitely and positively of measures that should be adopted to prevent the spread of the disease, and of the general hygienic management of those that suffer from it. Therefore it will be profitable to precede the consideration of general and special treatment by a discussion of these most important questions.

**Prophylaxis.**—The experience of the latest epidemic of influenza, which began in the autumn of 1889 and has recurred annually until the present date (1894), has shown that the disease is a definitely infectious one; or, more correctly, that while it is undoubtedly disseminated by the atmosphere, and with marvellous rapidity, its potential cause, the bacillus of Pfeiffer, multiplies in the bodies of those affected by it, and is thrown off in their exhalations, secretions, or discharges, and that, other things being equal, those that are brought into immediate personal relations with such persons are more liable to fall victims to the disease than are those not similarly exposed. Thus it often happens that when influenza attacks one member in a household, others are affected in quick succession, even though the epidemic may already have prevailed in the community for a considerable time. However, the atmospheric dissemination of influenza proves that the vitality of its germ may be preserved outside the body for a protracted period, and it is quite evident that isolation, which may be practised so successfully with other contagious diseases, cannot be relied upon with any confidence in the case of influenza. Leeson,[1] indeed, claims to have succeeded in excluding influenza from an institution with three hundred inmates by scrupulously protecting them from personal exposure. While such an experience has received some support, it is not in accord with general observation, and it seems probable that the most to be expected from isolation is the reduction to a minimum of the danger of infection.

[1] *British Medical Journal*, Dec. 5, 1891.

Unquestionably, the degree of protection that can be afforded will justify the separation of an influenza-patient from intercourse with all persons not necessarily attendant upon him. To effect this, isolation should be practised, as with the ordinary contagious fevers. It is doubtful, however, if equally vigorous measures should be adopted. At all events, it has not been shown that in the case of influenza there is the same danger of mediate contagion, and in the present state of knowledge the segregation of attendants and the disinfection of utensils, bedding, clothing, etc., hardly seem necessary. For practical purposes it will be sufficient if the patient be confined to a room that only the attendants are permitted to enter, and the ventilation of which will, so far as possible, prevent the dissemination of its atmosphere throughout the house.

On the other hand, prophylaxis, with relation to the conduct and management of the healthy, is most important, and when properly and intelligently carried out it will yield excellent results. It is doubtful if any drug can be depended upon to protect the healthy from the disease, though Tranjen[1] and Blanc[2] ascribe such powers to quinin given in daily doses of 0.50 gram (7½ grains), and Maclagan and Turner[3] to salicin given in doses of 10 grains (0.65) three times daily for many weeks. Richmond considers inhalations of oil of eucalyptus absolutely preventive.

It has been very commonly observed that those persons are least able to resist an epidemic influence whose general health is below the normal, and especially those already affected with catarrhal troubles of the respiratory tract. In times of epidemic, therefore, maintenance of a good state of general health places the individual in the best possible condition for successful resistance. This fact, however, has only relative significance, as those even in the soundest bodily vigor are attacked but too often. The healthy man, therefore, will diminish his risk of infection by holding aloof from persons already affected and from localities in which the disorder especially prevails. He should at the same time neglect no measure calculated to maintain his general bodily health.

**Treatment.**—Many cases of influenza follow a course so mild that little or no treatment is called for, or, at least, practised. The patient may not be compelled to withdraw from his daily occupation, or even to consult a physician. With more or less effort he resists the depressing influences of the disease, and with much discomfort, often with real suffering, struggles along until the attack has spent itself. Such behavior on the part of the patient should not receive the sanction of the physician. No matter how mild an attack of influenza may appear to be, he who unnecessarily exposes himself to unfavorable influences invites dangerous and often fatal complications and sequelæ. The development of a fatal pneumonia or dysentery or other disorder is a frequent result of such injudicious action. Bertillon has noted that while the deaths reported from influenza in Paris in December, 1889, and January, 1890, numbered but 213, the general mortality exceeded the average by 5500.

[1] *Therapeutische Monatshefte*, vol. 4, 1890. [2] *Lancet*, 1892, i. 165.
[3] *Lancet*, 1891, ii. 121.

When consulted, the physician should at once direct his patient to abstain from his ordinary vocation. Though it may not be necessary to confine very mild cases to bed, or even to the bed-room, they should be kept within doors for several days and be carefully protected against noxious influences. For such cases confinement to the house with careful attention to the diet and regulation of the various functions will be all that is needed, and medicinal treatment may not be indicated. In a few days after all febrile movement has subsided the patient may be permitted to go about cautiously.

Excepting these mildest cases, patients with influenza should always be kept in bed in a room to which no other occupant than the attendants should be admitted. The bed should be a single one, with a firm, elastic mattress. The bed-covering should be regulated by the temperature of the room. In winter, a small fire should, if possible, constantly burn in a grate or a stove, and the temperature of the room should not vary beyond between 62° and 70° F. (16.7°–21.1° C.). Proper warmth and ventilation are thus secured. Except in severe cases or those in which dangerous complications are threatened or have arisen, patients need not be compelled to use the bed-pan. The calls of nature, however, should be obeyed within the room. Within prudent limits, drinking-water, cooling drinks, cracked ice, etc., may be allowed freely. Except in adynamic and neurotic cases, stimulants will not be indicated, and their use should be discouraged.

The diet should be regulated according to the duration and severity of the case. Uncomplicated cases of influenza, even though severe, ordinarily terminate favorably within a few days. In such cases it is not a matter of grave importance that the patients should be plied constantly with nourishment. Much misapprehension exists upon this point, and not a little discomfort, and even positive disadvantage, may result from the injudicious energy with which attendants force a patient to eat. During a mild and uncomplicated attack, running a course of a few days only, a very light diet will be sufficient, will favor general comfort, and will even facilitate defervescence. Milk and broths will supply all that is needed. From a quart to three pints of milk given during the twenty-four hours will constitute a sufficient supply for an adult; or for a day or two animal broths and light farinaceous substances will prove sufficient. When, however, the attack promises to be longer, or when complications develop, in order to economize and maintain the strength of the patient more sustaining nourishment should be administered at once and systematically. Milk is still the preferable food. A full-sized man should have about half a gallon of milk during the twenty-four hours, given in divided quantities at intervals not greater than two hours. The white of an egg may be stirred into each glass of milk, and will not be unacceptable to the palate. Egg-water, made in the proportion of 1 tablespoonful of white of egg to 4 or 5 of water, and flavored, is an agreeable and nutritious drink. Strong animal and farinaceous broths, egg-nog, milk-punch, and the various preparations so useful in exhausting continued fevers are indicated. Solid food should not be permitted at the height of the disease. When the nausea that is so frequently

## ERRATUM.

Page 137, eighth line from the bottom.

For "potassium bichromate" read "potassium bicarbonate."

present proves formidable, much tact will be required in regulating the quality and the quantity of food. This is especially the case when dangerous complications or sequelæ become superadded to the depressing influences of the primary disorder.

It is difficult to say just what constitutes a simple, uncomplicated case of influenza. Catarrhal inflammation accompanies the disorder so constantly that the one may safely be said to belong to the other; when, however, catarrh passes into pneumonia, or when croupous pneumonia develops, or when gastro-enteritis or dysentery or nephritis or meningitis arises, influenza may be said to become complicated. Considered, then, within these narrow limits, simple influenza is not a very fatal disorder. Pepper[1] reports only 84 deaths from uncomplicated influenza in 35,413 cases of influenza collected by himself. This is a mortality of only about one-quarter of one per cent. In uncomplicated cases, therefore, treatment should be directed toward the comfort of the patient, the speedy amelioration of the symptoms, and the prevention of complications and sequelæ. As a rule, it is not well to begin treatment with a purgative. The tendency toward acute intestinal catarrh contraindicates such a measure. When constipation has preceded the attack, the administration of an enema or of a mild laxative will usually prove efficient. A small dose of castor-oil or, in the case of children, of aromatic sirup of rhubarb, or fractional doses of calomel given at short intervals, may be indicated.

It is fair to state that to a number of drugs has been ascribed a specific activity in the treatment of influenza. Heming[2] and Von Mosengeil claim specific virtues for salipyrin (antipyrin salicylate) given in large doses at short intervals. Heming offers the following formula:

℞ Salipyrin., ʒiss (6.);
Glycerin., fʒiiiss (14.);
Syrup. rub. idæi, fʒj (30.);
Aq. dest., fʒiss (45.).—M.
S. Shake well, and give a tablespoonful every fifteen or thirty minutes.

Althaus also considers salipyrin the most effective remedy against influenza. Robertson[3] recommends benzol in doses of from 3 to 5 drops. He maintains that in two hours after the first dose headache and backache disappear, and in about six hours the fever yields, not to return. The treatment should be continued for three or four days. Under this plan no sequelæ are said to develop. Crevar[4] believes that he has found a specific in potassium bichromate given in doses of 30 grains (2.) every third hour, and his claims are supported by experience at the Edinburgh Infirmary. "1. If used before the attack, it prevents the disease. 2. It destroys the power of the disease within twenty-four hours, generally within four or six hours. 3. The strength is conserved, and convalescence is short and satisfactory. 4. Sequelæ are conspicuous by

[1] *American Text-book of Medicine*, vol. i. p. 94.
[2] *Therapeutische Monatshefte*, Jan., 1892.
[3] *British Medical Journal*, Jan. 23, 1892.
[4] *Lancet*, Jan. 23, 1892.

their absence." Future experience may confirm one or all of these claims; at present they cannot be accepted.

The depressing and blood-crippling properties of the coal-tar derivatives have been urged as contraindicating their use in the treatment of influenza. The objection, however, is not well founded. The short duration of the attack (from two to eight days) places influenza upon a different footing from that of the longer-continued fevers. Excepting cases of idiosyncratic intolerance of the coal-tar preparations or of unusually profound nervous and general depression, the benefit to be derived from them in influenza is extraordinary. Though it can hardly be said that they materially shorten the duration of the attack, there is no doubt that they marvellously diminish the suffering and increase the comfort of the patient. They yield the best results in those cases in which from the beginning the characteristic pains of the disease are intense, when there are supraorbital pain and constriction, headache, pain in the back and the extremities, and the remarkable muscular soreness—symptoms usually associated with considerable fever. Marked amelioration will shortly follow a full dose, of from 5 to 8 grains (0.32–0.52), of phenacetin in capsule. The same result may be achieved with antipyrin in watery solution in doses of 15 or 20 grains (1.–1.3), or with acetanilid in capsule or tablet in doses of from 4 to 6 grains (0.26–0.39). The dose may have to be repeated several times at intervals of from two to three hours, but often the suffering and the fever will never regain their original intensity, and sometimes, indeed, the attack will seem to be much abbreviated. Occasionally profuse diaphoresis follows the full effects of the dose, and rarely undue depression, in which case it should not be repeated. The more frequently observed cyanosis following the use of acetanilid renders this drug less desirable than the others. Should the temperature rise unduly after the effects of the antipyretic have spent themselves, it may prove advantageous to repeat the dose from time to time until the attack yields. If, however, the course of the disease prove protracted, or in case severe catarrhal symptoms are present, or, especially, if graver complications arise, such as pneumonia, gastro-enteritis, etc., to administer these agents may prove not only undesirable, but positively disadvantageous.

Salol, salicin, and salicylic acid have yielded excellent results in the hands of many, and many have thought that they secured the best results from various combinations of the remedies already mentioned and of others. As a rule, however, combinations of drugs have not been found to be of any specific advantage in influenza.

Quinin has been very extensively employed in the treatment of influenza, often throughout its whole course, and is certainly a very valuable agent, though it will not give as prompt or as remarkable results as the coal-tar derivatives judiciously employed. It is probably, however, never depressing, and it is to be preferred for its tonic as well as its febrifuge qualities in more persistent cases or when complications are present. At the outset it may be given in full doses of the sulphate, preferably in solution. Its antipyretic effects are best secured by a few large doses, say of 10 grains (0.65) every third hour

for three doses. After its constitutional effects have been obtained the daily dose may be reduced to 10 or 12 grains (0.65–0.78). Some prefer the salicylate, and assert that it possesses advantages over the sulphate. The large doses, however, sometimes excite nausea and vomiting, and it is often preferable to give the drug subcutaneously. For this purpose the solution of the hydrobromate, containing 4 grains (0.26) to 20 minims (1.23), or of the hydrochlorate, containing 5 grains (0.32) to 20 minims (1.23), may be employed. With ordinary care subcutaneous abscess should never follow the hypodermic use of quinin. The discomfort that quinin does not relieve may be controlled by the concurrent exhibition of opiates.

Instead of internal remedies hydrotherapy has been recommended, and it is indeed a valuable therapeutic method. Cold-water applications to the head, or the ice-cap, will often relieve cephalalgia; and sponging the trunk and the extremities with tepid or cold water will lower temperature and greatly mitigate suffering. It will, however, rarely be found desirable to have recourse to cold water, as in a brief illness this treatment incurs inconveniences and disadvantages not insignificant, and does not afford results superior to those of the methods already mentioned. At the same time, when properly administered the cold bath is harmless and does not deserve the reproach made by Pepper, that it tends to increase liability to catarrhal and inflammatory complications.

When the profound adynamia which is so often a feature of influenza is present, antipyretic remedies should be used with great caution, and it may be necessary to avoid them altogether. The extent to which stimulants should be given will depend upon the condition of the patient. In debilitated and aged persons stimulants will nearly always be needed, and at times freely, but, as a rule, they are not required.

The characteristic pains in the head, the back, and the extremities often prove very obstinate and distressing. It may become necessary to fortify the action of other remedies by morphin given by the mouth or hypodermically. Much relief may be obtained by local treatment. Gentle friction and massage and anodyne applications are to be recommended. An excellent liniment is the following:

℞ Chloroformi,
Tinct. aconiti, *āā* f℥ss (15.);
Olei olivæ, f℥iij (90.).—M.
S. Apply with gentle friction or upon cloths covered with oiled silk.

If a more stimulating liniment is desired, compound soap-liniment may be substituted for the olive-oil.

Insomnia often proves a very troublesome symptom. Usually the alleviation of pain and discomfort is promptly followed by refreshing sleep, but quite often hypnotic remedies have to be resorted to. Sulfonal has been recommended for this purpose, but it is almost too slow in action. Chloral

hydrate, in doses of 20 grains (1.3) repeated in two hours if necessary, will nearly always induce quiet, restful sleep. Trional has in some cases acted admirably. In doses of 20 grains (1.3) it acts efficiently in about fifteen minutes, without unpleasant reaction. It must be remembered, however, that pure hypnotics do not act satisfactorily if the patient be racked with pain. In the latter case nothing can take the place of opium.

Some cases of uncomplicated influenza present much general nervous depression and cardiac debility. For these nothing is equal to strychnin, with or without alcoholic stimulants. The happiest results will often follow the administration of from gr. $\frac{1}{50}$ to gr. $\frac{1}{25}$ (0.0013–0.0026) of strychnin sulphate every third or fourth hour for several doses, by the mouth or subcutaneously.

The catarrhal element of influenza is very constant. Catarrh of the nasal, buccal, pharyngeal, and laryngeal mucous membrane in most cases requires no special attention. The supraorbital pain so often resulting from catarrh extending to the frontal sinus, it is said, may promptly be relieved by pencilling the nasal mucous membrane with a 5 or a 10 per cent. solution of cocain. For acute catarrhal pharyngitis gargles, sprays, and washes containing borax, boric acid, potassium chlorate, etc. are most useful; for example:

℞ Acidi carbolici, gr. xij (0.78);
Sodii boratis, ʒij (8.);
Sodii bicarbonatis, ʒj (4.);
Glycerini, fʒss (15.);
Aquæ rosæ, q. s. ad fʒviij (240.).—M.
S. Use as a gargle, spray, or wash.

The bronchial catarrh—which, however, may be absent—demands simple treatment medicinally. As a rule, cough-sirups are inadvisable, as they tend to nauseate and to increase anorexia. A simple sirup that may prove useful is the following:

℞ Morphinæ sulphatis, gr. ss (0.032);
Syrup. scillæ, fʒij (8.);
Syrup. lactucarii, fʒss (15.);
Aquæ, fʒvj (24.).—M.
S. A teaspoonful every second, third, or fourth hour.

If nausea be present and cough troublesome, but the bronchitis not severe, the following combination is often effective:

℞ Morphinæ sulphatis, gr. ss (0.032);
Acidi hydrocyanici dilut., ♏viij (0.49);
Spts. chloroformi, fʒiss (6.);
Aquæ menthæ virid., ad fʒiss (45.).—M.
S. A teaspoonful every third or fourth hour.

When bronchitis is pronounced, more stimulating agents will be required. Ammonium chlorid in varying combination will act with much advantage; thus:

℞ Ammonii chloridi, ʒj (4.);
Misturæ glycyrrhizæ comp., fʒvj (180.).—M.
S. A tablespoonful every third or fourth hour.

Counter-irritation should always be practised. Sinapisms applied over many areas are useful, but the best results are afforded by turpentine, applied as stupes or, warm, upon flannel. Blistering can hardly be required. In most cases of influenza the bronchitis is mild and does not involve the smallest bronchial tubes.

As the symptoms of influenza subside and the patient passes into convalescence, very deep depression and prostration, of both body and mind, often persist for a long time. Vigorous tonic treatment, medicinal, hygienic, and moral, will then be required. Protracted abstention from business and a change of scene may be necessary, and complete restitution of health is often long deferred.

**Complications.**—Dangerous complications and sequelæ of influenza are very frequent and are the cause of the shockingly great mortality that has followed its path. Pepper has shown that in Philadelphia "the total mortality for the month of January, 1889, was 1862, and for December, 1889, 1488; in January, 1890, the epidemic of influenza was at its height, and the mortality rose at a bound to 3044, of which number only 116 were reported as influenza." This enormous increase in mortality must have been largely due to complications of influenza. While, therefore, the treatment of influenza pure and simple relates principally to the comfort and speedy cure of its victims and the avoidance of complications, the treatment of complicated influenza and its sequelæ becomes a question of the highest importance. By far the most frequent and important complications are those involving the respiratory tract.

*Bronchitis.*—The demarcation between bronchitis as a symptom of influenza and as a complication is purely arbitrary. Probably it is best to consider the affection a complication only when the smaller bronchial tubes become involved. Such an extension greatly increases the peril of the patient, frequently leads to capillary bronchitis and broncho-pneumonia, and protracts the illness far beyond its usual limits, imperilling and often destroying life. Upon the supervention of such a bronchitis the attack loses its typical characters, retaining often, however, its profound depression. In most cases the treatment need not differ materially from that already laid down. Severer cases demand more energetic treatment, principally in the line of support. Depressing and nauseating expectorants should not be given. The usual cough-sirups rather do harm than good by their tendency to disorder the stomach. The stimulating and expectorant qualities of ammonium chlorid especially recommend it at this

time. It may be given in doses of from 5 to 10 grains (0.32–0.65) every third or fourth hour, in combination with the compound spirit of ether or other diffusible stimulant.

Small doses of opium may be given to control the racking cough—cautiously, however, as opium tends to check the expectoration, which now becomes copious and muco-purulent. The tonic influence of quinin is often useful. When signs of cardiac weakness develop, ammonium carbonate or aromatic spirit of ammonia will be indicated. These drugs, however, tend to irritate the stomach and to excite nausea and acute catarrh of the gastric membrane, and must be used with judgment. The high value of strychnin as a cardiac stimulant and tonic places it far beyond digitalis and the usual heart-tonics, and excellent results often follow its use, especially when combined with small quantities of belladonna or atropin. Counter-irritation plays an important rôle in the treatment at this stage, and should be employed persistently.

When bronchitis is intense, especially when passive engorgement of the right side of the heart is observed, and cyanosis develops, from 18 to 24 dry cups may be applied all over the upper part of the trunk; in suitable cases wet cups will often bring striking relief, and in extreme cases, when venous engorgement assumes alarming intensity, venesection to the extent of from 8 to 16 ounces of blood affords great alleviation. For any other object the abstraction of blood in influenza is to be strongly condemned. An even temperature of the surface of the chest should be maintained, but not through warm fomentations. An oiled-silk waistcoat will prove useful, but generally it will be better if the patient continue to wear an ordinary woollen undershirt. The wadding or cotton wrapping so often recommended will prove oppressive and uncomfortable. Inhalations of oxygen have yielded very happy results in the hands of Baccelli and others in cases of embarrassed respiration with cyanosis.

*Pneumonia.*—Broncho-pneumonia and croupous pneumonia are the most frequent of the dangerous complications of influenza. They occasionally develop at once, without especial exposure to their ordinary predisposing causes, but commonly they may be attributed to neglect or imprudence, and frequently thus arise even in mild cases of influenza. The occurrence of mild bronchitis should always excite lively apprehension, as either form of pneumonia may develop out of it, but broncho-pneumonia especially; and very much more often than is usually suspected, patches of lobular inflammation will be detected upon skilful examination. It is this condition that causes many of the cases of so-called "simple bronchitis" accompanying and following influenza to prolong the illness for weeks. Either of these complications demands the usual treatment appropriate to it, plus measures necessary to combat the depression attending the primary disease. Depressing remedies, always inappropriate in cases of broncho-pneumonia, are the more to be shunned now, and in cases of croupous pneumonia, whatever be the ordinary practice, such remedies can only imperil the chances of recovery. Blood-letting (except under

special indications already mentioned), aconite and veratrum viride, and all agents of their class should never be employed. The use of the internal antipyretics at this stage is also to be condemned, and even cold sponging and the cold bath, if used at all, must be applied with great caution. An exception may be made with regard to the ice-bag, which is sometimes extremely useful in relieving the distress of lobar pneumonia and in influencing the inflammatory process. On the other hand, supporting measures will always be indicated.

The condition of the nervous system and of the circulation will determine the administration or not of alcoholic stimulants. It is well to bear in mind that the pulse will afford better indications of failure than the temperature. Quinin, ammonia, and strychnin become the sheet-anchors of medicinal treatment, and should be given freely and at short intervals. DaCosta[1] considers digitalis the best remedy to support the heart, but he admits that in old people and in the presence of atheromatous conditions strychnin is safer. Insomnia, which not infrequently proves a source of nervous exhaustion, should receive unremitting attention. Chloral should be preferred to sulfonal, on account of its more speedy action. Trional often answers admirably, securing natural sleep promptly. DaCosta recommends paraldehyd and hyoscin, the latter in doses of gr. $\frac{1}{120}$ (0.00054). The pure hypnotics often fail when pain and discomfort are marked. A hypodermic injection of gr. $\frac{1}{8}$ (0.0081) of morphin, or gr. j (0.065) of opium in pill, repeated in two or three hours, will often allay nervous irritability and induce sleep. When the severe pain of pleuropneumonia is present and when the physical condition of the patient is good, most satisfactory results may often be had by combining with the opium from gr. $\frac{1}{16}$ to gr. $\frac{1}{12}$ (0.0041–0.0054) of tartar emetic. Active counter-irritation is always most important, though vesication is never desirable. Sinapisms and turpentine will prove most beneficial. The profoundly asthenic types of many of the pneumonias and pleurisies of influenza, at times resulting in pus-formation, accentuate the need of actively supporting and stimulating treatment.

*Cardiac Disorders.*—Enfeebled action of the heart is so frequently observed in the course of influenza that it may be considered one of the essential symptoms of the disease. For simple debility diffusible stimulants should be given. Baccelli[2] strongly recommends camphor, which may be given by injection (4 grains (0.26) dissolved in 15 minims (1.) of olive-oil). Sometimes the enfeeblement may be alarming. The heart-sounds will be indistinct, especially the first sound, the action quickened and very irregular, the radial pulse almost imperceptible. Upon the occurrence of such symptoms all agencies that may still further depress the heart's action should be abandoned or avoided. Antipyretic drugs should especially be withheld, and the patient should be compelled to rest quietly in bed and to avoid muscular effort. Alcohol, ether, ammonia, caffein, and precordial counter-irritation should be employed as directly stimulating. Digitalis and strychnin are the most reliable drugs when the tend-

[1] *International Clinics*, vol. i. 2d series, p. 17.

[2] *Lancet*, 1892, i. p. 220.

ency to heart-failure persists; they may be employed in full doses. Usually the symptoms disappear within a few days.

Mitchell Bruce noted as a sequel to influenza, continuing even for weeks and months, a tendency to faintness or severe anginal attacks.[1] Acute endocarditis, pericarditis, and myocarditis have not infrequently been observed. Robertson and Elkins[2] noted pericarditis in 5 of 140 cases. The treatment of these disorders does not materially differ from that advantageous under other conditions. Extraordinary cardiac weakness should constantly be looked for and guarded against. The prolonged debility of convalescence may favor the establishment of organic cardiac affections, and old lesions may be kindled into activity. Tonics and agents promoting the restoration of health will be required, and it is especially important that harmful influences should be shunned. Prolonged rest in bed, abstinence from improper food, protection from cold, and restriction of physical exercise may be required for a long time. The condition of the heart should be noted constantly during an attack of influenza, as organic disease of this viscus is by no means an uncommon complication or sequel.

*Gastro-intestinal Complications.*—There is a well-defined gastro-intestinal type of influenza, with an extreme limit of severe entero-colitis. Nausea and vomiting of mild degree are often present, and require no special consideration. Fractional doses of calomel repeated at short intervals, hydrocyanic acid, carbolic acid, lime-water, carbonated waters, cracked ice, small doses of brandy, and the usual remedies used to control these symptoms will suffice. At times, however, nausea and vomiting may be intense and almost uncontrollable. When the usual remedies have been employed fruitlessly, the patient should be kept perfectly quiet with his head low, and all food and medicine are to be withheld for hours. The stomach may be permitted to remain perfectly at rest and empty (for the exhaustion of inanition will only be intensified by the retching consequent upon ingestion of food of whatever kind); mild sinapisms or even a small blister may be applied to the epigastrium. After a proper interval of absolute quiet, teaspoonful-doses of milk, with or without lime-water or a carbonated water, may be administered cautiously at intervals of five, ten, or fifteen minutes, the quantity being gradually increased as tolerance improves, until the necessary quantities of nourishment will be retained. This method will rarely fail to lead to a restoration of the powers of the stomach within a few hours.

The danger of exciting obstinate diarrhea by active purgation has already been noted. When diarrhea becomes a pronounced symptom, it should be promptly controlled. The vegetable and mineral astringents are best avoided. Often simple remedies, such as chalk-mixture and bismuth subnitrate will be efficient, the latter in doses of from 20 to 60 grains (1.3–4.). The addition of an opiate will in nearly all cases bring the diarrhea to an end. A good combination is the following:

[1] Wilks has reported death from heart-failure.

[2] *American Journal of the Medical Sciences*, vol. i. p. 73.

℞ Tincturæ opii camphoratæ, fʒvj (24.);
Bismuthi subnitratis, ʒij (8.);
Aquæ, q. s. ut ft. fʒiij (90.).—M.
S. A tablespoonful every third or fourth hour.

Dover's powder in doses of from 3 to 5 grains (0.19–0.32) or tincture of opium, from 7 to 10 minims (0.43–0.62) every third or fourth hour, will not only alleviate the intestinal symptoms, but will also contribute to comfort and general improvement. Severe enteritis or entero-colitis may often be prevented by attention to this diarrhea. When these graver complications arise, they must be treated upon general principles and as they would be when arising from whatever cause, opium always proving the most reliable drug. Depletory measures especially should be avoided. If possible, a purely milk-diet should be maintained; at all events, solid food should be prohibited. Alcoholic stimulants will usually be needed, and the concomitant depression of the essential disorder must receive constant attention.

*Nephritis.*—Renal inflammation is a much more common complication of influenza than is usually supposed. Systematic examination of the urine will often reveal the presence of albumin and tube-casts. In most cases the alterations are transitory, and anasarca will only be found in severe cases. Prophylaxis will be best secured by careful hygienic precautions and by the maintenance of a milk-diet. Sometimes, however, influenza appears to have a selective action upon the kidneys and invades them in spite of precautions. Mild cases of nephritis will require no special treatment, and the ordinary treatment of influenza will often suffice, as in the majority of cases the symptoms disappear upon the establishment of convalescence or shortly afterward. Severe nephritis must be treated specially, and as nephritis from whatever cause. A strictly milk-diet will prove of immense value as a most important element of therapeusis. A very efficient and agreeable refrigerant diuretic is cream-of-tartar lemonade. Potassium acetate, potassium citrate, and potassium bicarbonate are also very useful. The infusion of digitalis is indicated when cardiac weakness is associated. It is possible that the local use of turpentine for chest-complications may by absorption exert a harmful influence upon the kidneys, and it should be practised with great care when renal irritation supervenes. When nephritis persists after influenza proper has disappeared, it should be treated as ordinary acute nephritis in a debilitated subject.

*Aural Complications.*—The middle ear is very often inflamed in the course of influenza, and perforation of the drum is by no means an uncommon result. At times this inflammation develops with the early symptoms, and perforation follows within a few hours. Care may often avert this complication. Non-conducting applications may be made to the external ears, and the throat and the nose may be sprayed with solutions of potassium chlorate or of boric or carbolic acid. After inflammation has developed the pain may be alleviated by instillation into the external auditory canal of solutions of cocain hydrochlorate (from 2 to 4 per cent.) or of atropin sulphate (from 2 to 4 drops of a

2 per cent. solution). If, however, the pain be very severe, it may be best to puncture the ear-drum at an early date. This operation, in giving egress to inflammatory exudation, avoids the less readily closing apertures made by suppuration. Perforation may occur even when pain has not been violent. These cases should be treated with frequent free injections of warm solutions of boric acid, from 8 to 12 grains (0.52–0.78) to the ounce (30.) of water. A soft-rubber ball-syringe is best for the purpose. The suppuration often persists for many weeks, and the perforations may endure. In the end hearing may be restored completely; very often, however, permanent impairment of hearing remains. Eitelberg[1] has shown that, in spite of severe aural inflammation and protracted intense pain, the course of this affection is very favorable and, as a rule, ends in complete recovery. For otitis externa solutions of boric acid or of carbolic acid are very beneficial.

*Nervous and Mental Complications and Sequelæ.*—There is no special indication for the treatment of these conditions. Many deny that influenza alone is sufficient to occasion a psychosis, asserting that it is only capable of giving the final impulse in persons already predisposed.[2] On the other hand, Mills,[3] Church, Wilks, and others believe "that the infection of influenza has a marked action upon the nervous system which may give rise to immediate acute manifestations or to remote and persistent conditions, and that in the predisposed grippe is competent to cause marked excitement or great depression of the motor, sensory, and mental nervous apparatus." In any case therapeutic measures directed against the great depression of influenza may be depended upon with most confidence to prevent or cure these disorders. Continued rest in bed, nourishing food, and tonic remedies are all essential. Stimulants will rarely be needed. Insomnia, which is very often distressing, may be banished by hypnotics, sulfonal, trional, chloral, or hyoscin. The bromids are most useful, not only as hypnotics, but also for their general quieting effect.

**Convalescence.**—The necessity for the utmost care during convalescence from influenza is shown by the frequent relapses and the serious, and even fatal, consequences following neglect of ordinary prudence. Whether the patient have developed complications or not, rest in bed should be insisted upon for several days after defervescence. The food should be assimilable, but considerable latitude may be allowed in its selection. Persistent anorexia may be corrected by stomachic tonics, such as the following:

℞ Tincturæ nucis vomicæ,
Acidi hydrochlorici diluti, āā f℥ss (15.);
Vini albi fortioris, q. s. ad f℥iij (90.).—M.
S. A teaspoonful in a half-wineglassful of water after each meal.

A glass of dry sherry or Madeira, or from half an ounce to an ounce of brandy or whisky at the midday meal, will often stimulate appetite and diges-

[1] *Therapeutic Gazette*, vol. xiv. 1890, p. 572.
[2] Kraepelin: *Deutsche medicin. Wochenschr.*, March 13, 1890.
[3] *Medical News*, Jan. 30, 1892, p. 121.

tion. Tonics containing iron and strychnin in combination will often overcome the persistent depression, physical and mental. This debility at times proves most obstinate, resisting all ordinary treatment, and not yielding until the patient has sought the distraction and invigorating influence of travel and sojourn at the seaside or among the mountains. In cases in which influenza has been complicated by severe bronchitis, pleurisy, pneumonia, or dysentery, and in persons predisposed to tuberculosis, the physician should never remit watchful attention until complete restoration to health is assured.

# DENGUE.

By J. W. McLAUGHLIN.

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Dengue is an acute infectious fever, of epidemic character, that almost always results in the recovery of the patient. Its treatment should be prophylactic and symptomatic. The latter should be directed to the relief of the fever, the temperature frequently reaching 106° F. (41.1° C.); of the violent pains (myalgia, cephalalgia, arthralgia, rachialgia), which have given the disease the name of "break-bone fever;" of nausea and inflammatory conditions of the gastro-enteric tract; of delirium and other disturbances of the nervous system; of the tendency to abort that is frequently manifested in pregnant women with dengue; and to the slow convalescence and the numerous sequelæ that usually attend this disease.

**Prophylaxis.**—It has been claimed that full doses of quinin afford protection from dengue, but this claim has not been sustained by later observations. My experience coincides with that of others who have found quinin absolutely without such prophylactic power, and it would seem, in view of McLaughlin's discovery in 1885 of a unique micrococcus in the blood of persons having dengue, that the disease is of microbic origin and, like others of its class, can be prevented only by quarantine, or at least by isolating the sick.

**Symptomatic Treatment.**—The administration of a purgative dose of calomel when the bowels are constipated, or of smaller doses, repeated if necessary, when this condition does not exist, given at the beginning of an attack, is a common practice with those who have had much experience in the treatment of dengue. I have followed this line of treatment, and feel confident that it relieves nausea and the disgusting taste so frequently complained of, and modifies the after-course of the disease. The mercurial may, if desired (and many prefer that it should), be combined with rhubarb or colocynth, or both, but I have found that calomel alone or with sodium bicarbonate or sugar of milk is more pleasant to take than when given with rhubarb or colocynth and equally as efficient. This treatment may be followed, with benefit to the patient, by giving occasional doses of pulvis effervescens compositus if an additional purgative is required; otherwise by liquor potassii citratis or liquor potassii citratis effervescens, either of which will prove a grateful febrifuge and will tend to relieve the nausea and the discomfort of the patient.

*Fever.*—The fever and the pains (cephalalgia, myalgia, arthralgia, etc.) can, in cases of ordinary severity, usually be relieved by copious affusions of cold

water to the head, by hot mustard foot-baths, by sponging the body frequently with tepid water, or tepid general baths, and by the administration of drugs, as follows: Tincture of gelsemium, gtt. x to xx, with sodium or potassium bromid, from gr. xx to xxx (1.3–2.) every three hours; or Dover's powder may be given in 5-grain (0.32) doses as required. Sodium salicylate, gr. xx (1.3), with caffein, gr. j (0.065) every three or four hours, has given great satisfaction, particularly in rheumatic varieties of dengue. Tincture of aconite and tincture of colchicum are also valuable remedies that have been highly recommended. That the full benefit may be obtained from affusions of cold water to the head of the patient, they should be thorough and repeated as often as may be necessary. The patient should be placed across the bed with his head projecting over its side, that the water may be applied thoroughly without wetting his clothing or the bed. Gently shampooing his hair and fanning it during the operation materially adds to its successful performance.

I wish to add my testimony to that of others regarding the value of gelsemium in dengue. It is not only a valuable febrifuge, but I have found it, when given in free doses, quite serviceable in ameliorating the pains and quieting nervous excitement. When combined with sodium bromid it is especially valuable in averting the convulsions that frequently occur in children with dengue.

Liniments containing chloroform, opium, belladonna, aconite, or other agents of similar properties, applied to the painful joints are, it is claimed, valuable adjuncts in relieving the patient's distressing pain, but I must confess that I have secured but little benefit from such applications. A tepid full bath will prove far more satisfactory in relieving these pains. Oil of wintergreen with equal parts of compound soap-liniment, to which may be added chloroform if desired, would, I believe, prove as serviceable in relieving the pains of dengue as it has in relieving those of rheumatism; it remains to be proved, however, that a liniment of this combination possesses any advantages over others that have been tried and found unsatisfactory.

While the plan of treatment outlined is quite sufficient to relieve mild cases or cases of ordinary severity, the more violent type of dengue, with hyperpyrexia, excruciating pains, delirium or convulsions, severe gastric or gastro-enteric phenomena, etc., demands more active treatment and the administration of drugs of greater power.

Hyperpyrexia is not an infrequent feature of dengue, but when not associated with symptoms of a grave nature, it will not require more active measures than those that have already been referred to—namely, copious affusions of cold water to the head; hot mustard foot-baths; tincture of gelsemium, sodium salicylate, and liquor potassii citratis. When the fever does not yield to these measures, the cold or the modified full bath or the cold wet pack may be tried. I prefer the modified cold bath, as it does not cause the shock that so often occurs from plunging a fever-patient in cold water. While this shock is doubtless of value in adynamic fevers that threaten life, as it arouses the depressed vital powers of the patient and increases his resistance to poisonous toxalbu-

mins, this condition does not exist in dengue; life is not often threatened in this disease, and the only purpose of the cold bath is to reduce high temperature, and this is best and most safely accomplished by placing the patient in water at a temperature of 90° or 95° F. (32.2°–35° C.) and afterward reducing the temperature by adding cold water. We can by this method avoid nervous shock and secure as good and more lasting antithermic effects than can be obtained by the cold bath.

The cold wet pack also offers an efficient means of reducing hyperpyrexia, especially in dengue of children.

Antipyrin, acetanilid, phenacetin, and other coal-tar derivatives that possess antipyretic properties will doubtless prove valuable in dengue, not alone as antithermics, but as analgesics as well, and they promise to serve a double purpose—to reduce fever and to relieve pain.

Morphin injected hypodermically is the most prompt and reliable remedy for the violent pains of dengue, and when it is not contraindicated by an idiosyncrasy or by the condition of the patient this drug should be given in those obstinate cases of violent pain that refuse to yield speedily to milder measures. It is also the best remedy in cases of pregnancy when abortion is threatened. In this condition milder measures, if employed to the exclusion of opium or its salts, will certainly involve a loss of valuable time, if they do nothing worse.

When convulsions are threatened or occur, as frequently happens in children, chloral hydrate and potassium bromid should be given, and, in addition to these, antithermic remedies should be vigorously pushed, especially applications of cold water.

Chloral hydrate should be given by the mouth when the patient's stomach will tolerate the medicine; otherwise it should be given in increased doses by the bowel. Potassium or sodium bromid with tincture of gelsemium should also be given in full doses, and are valuable medicines in this condition. That the bowels, if constipated, should be freely opened goes without saying.

When nausea and vomiting do not yield to milk and lime-water, to small pieces of ice permitted to slowly melt in the patient's mouth, to carbonated waters, or to the sipping of hot water or aromatic teas, they will generally yield to small doses of morphin by the mouth or hypodermically, or to carbolic acid or cerium oxalate given as the condition of the patient requires.

Enterocolitis and dysentery are troublesome complications that often arise during the course of dengue. When the discharges from the bowels are copious, offensive, and frequent, bismuth subnitrate, in combination with opium and salol or salophen, has been found quite serviceable. Opium, silver nitrate, and extract of nux vomica form another valuable combination in this condition, as do also tincture of simaruba officinalis, tincture of calumba, and deodorized tincture of opium given in compound elixir of taraxacum. When the patient's tongue is heavily coated and his breath is offensive, small doses of calomel carefully guarded by opium are required. Acute dysentery will yield to magnesium sulphate and opium supplemented by frequent enemas of cold water. The following formula has been found efficient:

℞ Magnesii sulphatis, ℥j (32.);
Morphinæ sulphatis, gr. j (0.065);
Acidi sulphurici diluti, f℥ss (2.);
Syrupi, f℥j (30.);
Aquæ cinnamomi, ad f℥iv (120.).—M.

S. A tablespoonful every three or four hours.

Cold water should be injected into the bowel in small quantity—say 2 ounces (60.) after each action. When the disease is subacute and involves the colon to any considerable extent, the injections should be larger, 2 or 3 pints—and powdered borax, alum, or solution of chlorinated soda, 1 part to 20 of water, should be added to the irrigating fluid.

Impairment of appetite, often amounting to anorexia, and mental and physical exhaustion, which mark the tardy convalescent stage of dengue, will require a judicious selection of tonics, stimulants, and reconstructives, to spur the appetite, restore the impoverished and poisoned blood, and meet whatever sequelæ may arise during this stage. Iron, strychnin, and other vegetable tonics, phosphoric acid, wine and malt liquors, cod-liver oil, and cold shower-baths are mentioned as some of the most prominent remedies that may be required. The more obstinate cases may even require a journey, a sea-voyage, or a change of residence for perfect restoration to health.

# THE EXANTHEMATA.

By GEORGE DOCK.

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**The Public Hygiene of the Exanthemata.**—Certain problems relating to the eruptive fevers belong to the domain of public hygiene, but it is necessary for practising physicians to be familiar with them, as it is neither practicable nor expedient that the prevention of the spread of these diseases be taken entirely out of their hands.

In most places there exist laws or regulations having for their ultimate object the limitation or prevention of infectious diseases. These laws are not always wisely made, and often are impossible of enforcement either in letter or in spirit; yet, as the State or the community has the right to make and enforce them, the physician must be familiar with them so far as they affect him or his patients, and must follow them. Such regulations refer especially to the notification of the occurrence of certain diseases, among which are usually scarlet fever, enteric fever, typhus fever, small-pox, diphtheria, cerebro-spinal meningitis, and whooping-cough, and in some places measles, German measles, chicken-pox, tuberculosis, and erysipelas. It would seem that the notification of these diseases to the health-officers or to boards of health would have many advantages, but the practical working of such rules is not always satisfactory.

Another regulation has for its object the isolation of the sick or the suspected or their removal to special hospitals. This rule, especially the latter part, often throws a grave responsibility on the physician. His first duty is to endeavor to afford his patient the best chances for recovery. There can be no doubt that the best treatment of cases of the diseases under consideration can be carried out only in special hospitals, with separate wards, not too large nor too crowded, for each disease, with isolating-rooms for cases not yet diagnosticated, and with experienced physicians and nurses and suitable appliances. But such hospitals are rare, and even where they do exist they do not always suffice in epidemics of extraordinary extent. In the United States, hospitals of this kind exist only in a few places, and those usually provided for the eruptive fevers are of a kind only to be described by the barbarous term "pest-house." To send to such a place a patient who might have even the least adequate attention in a private house, and whose treatment in that house would not seriously menace the public health, should never be advised. In such a case, if an effort is made by the authorities to remove the patient, the latter should be advised to go only under protest, or even to resist removal. It is only when protest has been made that the patient can recover damages for injuries

resulting from the moving or from the hospital treatment, and it is usually only by such drastic experiences that cities can be brought to provide proper hospitals for the treatment of the eruptive fevers.

In connection with the matter of notification the question of diagnosis often arises. It is well known that in many cases of small-pox, measles, scarlet fever, and other exanthematous diseases the diagnosis remains long in doubt, often beyond the time within which notification is required. In such cases it is proper to notify the health-officer of the suspicion and to allow him to share the responsibility. Under these circumstances an exact diagnosis must not be announced until it is clear, but the probabilities must be explained and the precautions taken that would be necessary if the case were the most serious possible. For example, if the diagnosis rests between small-pox and measles or small-pox and chicken-pox, the case should be treated as one of small-pox until it has been found to be otherwise. A similar policy should be followed in the commoner difficulty of distinguishing between scarlatina and some less serious disease. As an illustration may be cited an instance that came under my own observation. Scarlatina and rubella occurred together in a place in which neither had been seen for some years. A number of physicians, including the health-officer, took the ground that all the cases were examples of rubella, and not only defended this view in medical-society meetings and in consultations with the board of health, but acted on their convictions in practice. The result was that their patients had nephritis to an unusual extent. On such occasions the welfare of the patient should be considered superior to questions of exact diagnosis or of theory, especially with sporadic cases or in the beginning of an epidemic.

An important matter in the preventive treatment of the exanthemata is the care of suspects, that is, persons who have been exposed to infection, but who do not present definite symptoms of the disease. It would be safest, no doubt, to keep such persons isolated for the longest period of incubation allowable for the disease in question; but in practice this plan is difficult or impossible of execution, and even if it were possible to quarantine suspects during the necessary time, so many other persons exposed would escape notice that the public would be only imperfectly protected. This subject is of especial importance in connection with the detention of school-children in whose homes cases of the eruptive fevers occur. It would of course be best to send children probably exposed to infection to observation hospitals or detention hospitals, but as such a course is usually impossible, the children are simply kept out of school until disinfection of the premises has been practised. This involves certain errors and certain risks. If proper precautions are taken, persons in the same house, not previously exposed, cannot act as carriers of the disease. Others may already be infected, but in a stage too early for recognition; but as neither of these can be detained in the house during the whole duration of the primary case, facilities for infecting others in the street are not wanting, and are all the more dangerous because beyond observation or control. As long as detention stations cannot be provided, the best plan would be to keep all suspected persons

under the observation of physicians appointed for the purpose, who could conveniently examine children in the schools, which the children would continue to attend until declared sufficiently suspicious to be sent to hospitals or isolated for treatment. Or it might be possible to require teachers to be familiar with the appearance of the normal throat and the simple methods of its examination, and also to know the common symptoms of the eruptive fevers and to make daily examinations of their pupils during the existence of an epidemic, all cases presenting suspicious symptoms to be referred at once to a physician for further examination or, if necessary, for treatment. It would certainly be much better for the community if the money now spent in many States on the teaching of absurd ideas regarding physiology, falsely so called, were devoted to some such method as that here mentioned. Instead of the doubtful prevention of cirrhotic liver and tobacco-heart we should then have a very certain diminution of nephritis, diphtheric paralysis, endocardial and myocardial disease, deafness, and blindness.

As quarantine (in the old sense) of suspects cannot be carried out with anything approaching thoroughness, such persons should at least be kept under observation for a time covering the maximum period of incubation of the disease to which they were exposed. Still, as has already been said, although the physician may differ with the authorities, and should endeavor to improve health-laws whenever possible, he should never neglect to carry out rules already in force in his own field of practice.

Our knowledge not only of the treatment but of the prophylaxis of the exanthemata is based on the results of experience, but we can apply with advantage some of the results of laboratory investigation in the etiology of other diseases. Modern research shows that infection through the air is by no means so common an occurrence as was formerly supposed, and although we have a certain amount of ground for believing that in small-pox, for example, infection takes place through the air more frequently than in typhoid fever or cholera, we cannot avoid the belief that in the exanthemata the best possible results will be obtained by applying the rules now followed in the case of other diseases—that is, by endeavoring to check the spread of disease at the body affected. By cleanliness of the patient and his surroundings, by the destruction of all possible carriers of disease-germs, by disinfection of secretions and excretions, and by cleanliness on the part of nurse and physician, we are now able to limit the spread of many diseases more definitely than was possible when the belief was fixed that the infection would spread no matter what was done, and especially that it would spread through the air as volatile matter.

**The Sick-room.**—In treating a case of one of the eruptive fevers in a private dwelling, a room should be used that is, or that may be, cut off from all persons not concerned in the care of the patient. Usually a room in the top story, at the end of a hall or a corridor, is the best, but in some houses it may be preferable to use a room on the ground floor, with doors opening on the outside, and which is more convenient. The apartment should be airy

and capable of being well ventilated. Usually the best way of increasing the ventilation of ordinary bed-rooms is by introducing strips of wood about three inches wide below the lower sash, so as to make an open space between the upper and lower sashes. It is a great advantage if two communicating rooms can be used, the outer one of which may serve as an ante-room. The sick-room should have a fire-place or a stove, not only for heating the room in cold weather, but also for ventilation and for the heating of water and food, the burning of dressings, etc. It should, as a rule, be light and cheerful, but it is often necessary in the beginning of serious diseases or in the case of complications on the part of the eye or brain to have the room darkened. It should contain only the necessary furniture, without carpet or hangings. If possible, a bed should be used that is not too large, as it is much easier to care for a patient in a narrow bed; the patient himself is usually indifferent in the matter. The mattress should be light but firm, so that the patient cannot sink down in it. A hair mattress on a wire frame is best.

In practice it is often necessary to treat a patient in an ordinary bed-room. In such cases all useless furniture and impediments should be removed and disinfected; other things can be left for disinfection after the termination of the case. A room occupied in the beginning of a case of one of the contagious diseases, but vacated for a more suitable apartment, must in all cases be treated, together with its contents, as if it had been used during the whole course of the disease, and under no circumstances may it be occupied by others until it has been disinfected and thoroughly aired.

**The Nurse.**—As the successful treatment of the exanthemata depends very much on constant care and watchfulness, an experienced nurse should always be in attendance if possible. If inexperienced persons have to be depended upon to do the nursing, it is necessary for the physician to give the most full and explicit directions and to see that they are observed, and this requires the making of so many more calls that on the score of cost alone trained nurses involve a saving to the patient rather than the reverse. All directions to the nurse should be put in writing. The details of treatment, the observations of temperature, pulse, respiration, and other symptoms, must be recorded at the time, and the giving of food and drink and of medicines must all be noted in an orderly way, "black on white." The nurse must not mingle with other persons except after complete change of clothing and disinfection, but must remain isolated and must follow careful rules in regard to disinfecting her own person and clothing.

The physician himself has certain things to do in connection with the care of the exanthemata, other than the prescribing of treatment and the observation of symptoms. The idea that has at times been advanced that physicians never convey infectious material from cases of these diseases is hardly entertained now. It would be easy, but it is unnecessary, to mention instances demonstrating the contrary. Every precaution should therefore be taken to avoid the possibility. In order to do this, however, it is by no means requisite to adopt any of the absurd kinds of dress that have been proposed. The best

plan, which can often be followed in private practice, is that usually adopted in hospitals for infectious diseases, and which consists in the use in the sick-room of a long wrapper like those worn by surgeons in operating, and which is put on and taken off in the ante-room or at the door of the sick-room. Unnecessary contact with the patient or the bedding should be avoided; examinations should be made as brief as is consistent with thoroughness; and at the conclusion of the visit the wrapper should be removed and the hands be washed thoroughly. Physicians or others who have to do with highly contagious cases, and who are not known to be immune, should avoid visiting cases of the exanthemata when hungry or fatigued. The use of a mild antiseptic gargle after exposure is perhaps a useful procedure, but washing of the hair, as has been recommended, is hardly practicable. After visiting such cases the physician should so arrange his other visits, if possible, that he does not at once see children or other presumably predisposed persons; and after seeing cases of scarlatina, small-pox, or erysipelas he should not see surgical or obstetric cases until after complete disinfection. Usually the most convenient plan is to visit contagious cases last and then to practise thorough disinfection, changing the clothing if necessary.

**General Therapeutics of the Exanthemata.**—The treatment of the exanthemata at the present time is, as it should be, a treatment of the patient rather than of the disease. The leading indications are the prevention or the treatment of secondary infections and the maintenance of strength until the violence of the disease is spent. In fulfilling the second indication a number of symptoms have to be combated, such as high temperature, weak heart, poor digestion and assimilation, failure of excretion of toxic substances, loss of sleep, pain, and complications on the part of various organs. It is in the treatment of these symptoms that the skill of the physician shows itself, the essential aim being the avoidance of unnecessary drugging on the one hand, and the preservation of the patient to the utmost on the other. Exact observation, perfect weighing of clinical evidence, a large experience in the natural history of disease, the ability to make "the patient, the attendants, and externals" co-operate with him,—these are some of the elements necessary to successful treatment.

Although the exciting causes of the exanthemata still remain unknown, numerous investigations in each and every one of them make it certain that danger often results from the action of the common microbes of suppuration. Cases dying from or endangered by the severity of the primary or specific infection are on the whole rare, and for the most part are beyond the reach of treatment other than stimulants. Even before the scientific study of the secondary infections it was appreciated that methods of treatment that we now know included antisepsis, as of the throat in scarlet fever, were of great value, and our present knowledge of the modes of entrance of the organisms mentioned leads us to apply similar methods to all the possible avenues, such as the eye, nose, throat, skin, etc.

The pharynx must be looked upon as a point of the greatest importance,

and must be watched closely and treated carefully. In all cases cleanliness in its simplest conception must be sought, but the means to be used for attaining this end will vary in different diseases and in different patients. In all cases in which the patient can carry it out, gargling, properly done, constitutes one of the most important of these means. This is so useful that children should be taught early to practise it. It would, in fact, be well if the practice were more prevalent at all ages. Looked at simply as an ablutionary measure, the failure to cleanse the throat among people that consider themselves cleanly is a remarkable fact.

For gargling in ordinary cases the mildest antiseptics should be used. Dobell's solution[1] diluted with from 1 to 3 parts of warm water is a very useful preparation. A saturated solution of potassium chlorate is also useful, and may be combined with an aromatic.

The advice, given formerly more frequently than now, to swallow the gargle after using it cannot be condemned too strongly. If the gargling is efficient, the result is that the patient swallows a larger or smaller amount of half-putrid, perhaps pathogenic, material, which enters a stomach already much reduced in the power to protect itself.

With patients who cannot gargle the gentle and expert use of a pharyngeal swab, conjoined with a nasal douche, should be practised. In cases in which the vault of the pharynx or the nose contains unusual products or is inflamed this procedure must be practised carefully. A fountain-syringe can be used for this purpose in most cases, but in some, at the beginning, or if the cleansing is not done with sufficient frequency, the nares become occluded and the current will not pass through. In such cases it is useful to adapt a small soft-rubber catheter to the syringe, pass the tip far back, and then irrigate the parts from the pharynx. With patients who cannot tolerate the nasal douche, especially children, the nose can be washed out with the aid of a small soft-rubber syringe. All of these operations about the nose and pharynx must be practised with the utmost gentleness and dexterity, so as not to excite the patient or induce struggling.

As solutions for application to the nose and pharynx, boric acid and Dobell's solution can be used. They should always be warm. After washing out the nasal cavities it is well to grease the external parts and the entrance to the nares with vaselin or cold cream, or a spray of liquid petrolatum, with or without antiseptics. A mixture of glycerin and thymol or similar combination can also be used.

The mouth must be kept clean by the use of a tooth-brush and water, reinforced, if need be, by antiseptic solutions. After every dose of medicine and every feeding the mouth should be cleaned carefully.

[1] ℞ Sodii borat., Sodii bicarbonat., āā ʒiv (16.);
Acid. carbolic., ʒiss (6.);
Glycerin., fʒxivss (58.);
Aquæ, q. s. ad fʒviij (240.).—M.

The condition of the skin is of great importance in all cases. Cleanliness is to be kept up by bathing and by frequent changing of the bed-linen and body-linen. Bed-sores must be prevented by keeping the skin clean and dry, by protecting parts exposed to pressure, by changing the posture so that different parts are exposed only for a short time, and by the use of hardening agents, such as alcohol, or of drying powders.

At least once a day the whole surface of the body should be examined, and alterations of the skin, or such complications as distention of the bladder, or tympanites, noted, and appropriate treatment applied.

In regard to the evacuation of the bowels and the bladder many important details must be observed. The number and character of the stools must be noted on the record. The non-observance of this simple proceeding often results in a constipation that may not only produce unpleasant or alarming symptoms, but may even lead to conditions that will seriously complicate the case.

The urine must be examined daily as to amount and other characteristics. In all febrile conditions it is not enough to do this, but the suprapubic region must be examined daily by palpation and percussion in order to make certain that retention does not take place.

Fever.—It is now very generally admitted that high temperature in itself is not a common source of danger in the course of the exanthemata, and even those who do not make this admission rarely advise the routine administration of antipyretic drugs. In diseases of as short duration as scarlatina and measles a temperature of 103° or 104° F. (39.4°–40° C.) can be borne without danger or inconvenience, and higher temperatures lasting but a few hours are not so dangerous as has been thought. It is thus by no means necessary to have recourse at once to the powerful antipyretics with which we are now so liberally supplied. Not only are these drugs unnecessary, but I have taught for years that it is bad practice to prescribe the coal-tar antipyretics in the early stages of febrile diseases, for another reason. By giving antipyrin or one of its rivals in a case of eruptive fever, or a febrile disease supposed to be such, we run the risk of either altering the character of the eruption and the temperature-curve, and so rendering the diagnosis difficult, or of producing an accidental rash that may cause even greater confusion.

As an antipyretic in the diseases under consideration I have long used some of the older remedies (liquor ammonii acetatis and other saline diuretics), now unduly neglected on account of the vogue of the more powerful antipyretics. In febrile conditions the spirit of Mindererus, by its diaphoretic and diuretic actions, constitutes a useful remedy on theoretic grounds, and the fall in temperature that frequently follows its administration will surprise those who have used only the modern antipyretics. Of the newer remedies I prefer phenacetin, given in smaller doses than those generally recommended, seldom exceeding 2½ grains (0.16), repeated every hour or two until the temperature falls.

Another useful agent in the treatment of the fever of the exanthemata is

water externally; but, unfortunately, our precise knowledge of the best methods and the special indications is very limited. The work of numerous men, from Currie to the most modern of our contemporaries, gives evidence of the great value of bathing in the eruptive fevers, but the same causes that prevent the systematic use of bathing in typhoid fever, in which the conditions are infinitely clearer, also prevent a wider use of this agency in the exanthemata. This question will be discussed more fully in connection with the treatment of scarlatina.

Nutrition is not so important in some of the exanthemata, on account of their shorter duration, as in other febrile diseases, but its precise relations must be remembered in each case. The general fact must be borne in mind that in the beginning of such cases there is sometimes not only complete loss of appetite, but often, besides, troublesome nausea or vomiting, which together make it impossible to retain anything on the stomach. Under these circumstances no attempt should be made to feed the patient until the stomach has been relieved. In persons previously in good health, starving for two or three days will do no harm.

The old fashion of giving the patient a preliminary purging is one of considerable value, calomel in broken doses or in one moderate dose, and followed by a saline, being usually best. The vomiting of the onset should be encouraged by the use of warm water until the stomach is empty; but if it continue unduly it should be allayed by the use of bismuth, by cracked ice, sips of aërated water, the application of a spice-poultice or a mustard-plaster over the epigastrium, etc. After this the patient should be given a mild diet varied according to the special indications. As a routine practice skim-milk makes up the bulk of the diet during the febrile stage. The amount should be guided by the patient's digestive ability as shown by the condition of the stools. Usually from 4 to 6 ounces (120.–180.) should be given every two hours. If the stomach remains irritable, a tablespoonful of lime-water should be added to each portion of milk, or Vichy or Apollinaris water can be substituted in quantities of from 1 to 2 ounces (30.–60.).

As substitutes for milk, if a quantity approximating that stated cannot be taken, albumin-water (made by beating the white of an egg with water, plain or aërated), or any gruel, can be used with benefit. Animal broths are useful after the febrile stage or when the patient's appetite must be encouraged, but in the earlier periods they should not be used to the exclusion of any portion of the milk. As other substitutes for milk, koumiss and matzoon are very useful, and, although much less valuable, peptonized milk, which can seldom be taken so readily as the others.

An important point in the treatment of febrile diseases is to give the patient plenty of pure water. This is necessary partly to supply sufficient urinary water to flush out the kidneys and remove effete matter. A good guide to the amount is furnished by measuring the urine and endeavoring to keep the total for twenty-four hours at between 2 and 3 pints (1000.–1500.). Besides the flushing out, the absorption of a sufficient amount of water tends to keep up

the strength of the heart and lessens to a marked extent the depressing feeling of weakness.

The functions of bowel and bladder must be looked after carefully. After the preliminary purgation it is rarely necessary to use drugs to move the bowels, but enemata should be relied on to provoke stools at intervals of one or two days.

The treatment of other symptoms will be described in connection with the different diseases.

Although we may continue to hope that we shall at some time be able to treat the exanthemata in a more specific way, either by drugs or by so-called "vaccination methods," and while attempts to find such methods must be considered legitimate, for the present we must follow the results of experience with the older methods.

**Prophylaxis.**—Certain aspects of prophylaxis have been mentioned in the preceding pages. It remains now to consider others.

The best method of disinfection is by burning, and this should be applied to all articles of slight value, such as rags used as handkerchiefs, or wash-cloths, or clothing of little value.

Clothing and bedding, for the most part, must be used over again, and require different treatment under different conditions. Clothing not grossly soiled can be disposed of by being placed at once in a boiler and being boiled for half an hour, provided the boiling be thorough and the vessel be not too full. This can be done in the sick-room sometimes; or if the goods to be washed are made wet or are put in a wet bag or in a closed box and sent directly to the boiler, no harm will result. Such things, however, should never be washed out in cold water by hand, as infection may be conveyed to the washerwoman or from her to others.

Clothing soiled by discharges, blood, pus, etc. cannot be disposed of in this way, as the goods run the risk of being spotted, or the discharges may become fixed in the stuff. In order to prevent this the pieces should be left for at least six hours in a 3 per cent. solution of lysol, after which they can be washed in the ordinary way.

The disposal of feces and urine must vary according to the local conditions as regards sewers and cesspools. In the diseases under consideration we have no evidence that these discharges contain infectious material, although in small-pox such an assumption is highly probable. If the discharges are to be emptied into cesspools or into sewers so built that contamination of the water-supply cannot take place, nothing is needed beyond observing scrupulous cleanliness of water-closet seats, floors, and walls, and of the vessels used for the dejections. If there is no cesspool, the stools and the urine, mixed with milk of lime, should be poured into a hole dug in the ground for the purpose, remote from the possibility of contaminating wells, and made inaccessible to all but the persons who have to do with the disposal of the discharges. In such cases some milk of lime (freshly slaked lime), solution of lysol, or solution of chlorinated lime (calx chlorata 1 part, water 5 parts) should be poured into the bed-

pan before use, and another portion should be poured over the dejection as soon as passed. After use the vessel must be cleaned with one of the solutions mentioned. Urinals also are to be kept clean by the use of one of the solutions named.

Water used for bathing the sick can be disinfected by adding quicklime in the proportion of 2 per cent., though if the water can be poured into a proper cesspool this is not necessary.

After recovery or death in a case of exanthematous disease the sick-room and its contents must be disinfected carefully.

For the disinfection of clothing a steam-sterilizer is best, but is often not available. Under the latter condition the articles of clothing should be exposed to the sun for two or three days, out of the reach of children, and afterward be cleaned in various ways according to their quality. This sunning and airing can be done conveniently after the room has been disinfected. For the latter purpose disinfection by fumes of sulphur is in many places directed by law, but this should not be depended upon alone, except in the case of the milder diseases, like measles. In order to carry out the procedure, the room must be prepared so that its contents shall have as much surface exposed as possible. Clothing, bed-clothing, and other articles should be arranged in the center of the room. Carpets or rugs must be raised from the floor and be exposed on all sides. All the openings into the room are then to be closed and the sulphur is to be prepared. This can be used in the form of sticks or of the cakes made for the purpose, to the amount of not less than three pounds for every one thousand cubic feet of space. The sulphur, which should be placed in an iron pan raised above the floor on bricks, is to be fired by hot coals or by the aid of alcohol ignited by a match, or by the wicks in the prepared cakes. As soon as the sulphur ignites the door is closed, is sealed on the outside by pasting strips of paper over the joints, and is left closed for twenty-four hours. On the next day the room is carefully opened and the fumes are allowed to escape without creating a strong draft. All articles of clothing are to be removed, for exposure to the sun or to be cleaned. Carpets are to be exposed to the sun and to be beaten out or cleaned by the mechanical methods. Pillows, mattresses, and upholstered furniture of slight value should be burned.

The disinfection of the walls and ceilings is then begun, and varies in its method according to circumstances. If the walls are papered, they should be rubbed down with bread, which is to be burned at once, or else the paper should be scraped off and burned. The ceiling can be wiped with a moist mop or be scraped and repapered. Plain, hard-finished walls can be cleaned with bread or wiped off with a solution of carbolic acid. Whitewashed walls should be rewashed. Painted walls can be washed in the ordinary way.

All the wooden or metallic parts of furniture, including window-sashes, should be washed with carbolic acid and afterward with water. The unpainted backs of pieces of furniture can be covered with milk of lime, which can be brushed off after it dries. Picture-frames, mirrors, etc. can be cleaned with

bread. Toys of value can be cleaned with carbolic acid. Clothing and furniture, as also books, boots, and other articles of leather, which cannot be disinfected by steam or by washing should be exposed to the sun for several days. Furs can be moistened thoroughly with carbolic solution, partially dried with old rags, and then dried thoroughly in the air.

Finally, after the room has been emptied of its contents the floor is to be cleaned thoroughly with soap and water, care being taken to clean all cracks and joints. After this the room is to be left unoccupied, with the windows open, for several days.

The cadavers of persons dying of eruptive fevers should be wrapped at once in sheets soaked in carbolic acid or in a solution of zinc sulphate (zinc sulphate 4 ounces (120.), common salt 2 ounces (60.), water 1 gallon—4 l.). In most places boards of health provide that newspaper notices of such deaths must state the cause of death and that the funeral must be private, but it is often necessary to notify the friends that no one must "sit up with the corpse," an event that may take place unless prohibited.

The strict disinfection described should always be carried out in cases of scarlatina and small-pox. In the case of the other eruptive fevers rigid disinfection of clothing, furniture, etc. need not be practised, but the room and its contents should be disinfected by sulphur if required, and then be aired for several days, the contents being aired in the sun, clothing being washed, etc.

## Scarlet Fever; Scarlatina.

The physician has an important duty in connection with scarlatina: that is, instructing the public, whenever the necessity arises, that this is always a dangerous disease. The old idea still prevails to a certain extent that by the medical term "scarlatina" or the popular expression "scarlet rash" a mild or benign form of scarlet fever is indicated. To the experienced, scarlatina is dreaded because of its protean character, because of its tendency to assume without warning a totally new aspect, so that during the acute stage the outcome cannot safely be predicted with anything approaching certainty, and because one of its most dangerous complications is likely to occur from lack of care in the cases that to the inexperienced seem scarcely deserving the name of disease. As the mildest cases are subject to many of the complications, including those of the latest stages, every case must be watched carefully, not only during the acute stage, but for a long time afterward.

The general therapeutic indications in scarlatina are those already mentioned—namely, to prevent or lessen the severity of secondary infection, and to mitigate the severe effects of the principal disease.

The germ of scarlatina still remains unknown. None of the organisms that have been cultivated from the skin or the other surfaces can be said to have any claim to recognition as the cause of the primary disease. Notwithstanding the close similarity of the symptoms of scarlatina to those of certain cases of streptococcus-infection, the view of Bergé that the disease is originally a streptococcus-tonsillitis cannot be accepted. It has long been

believed that the virus of scarlatina is less diffusible through the air than that of the other exanthemata; that is, that there is less danger of infection at a distance. A point of greater importance is that the virus is possessed of remarkable tenacity, as articles infected by previous cases have been observed to possess virulent infectiveness after almost incredibly long periods. The patient is liable from the earliest stage to communicate the disease to those with whom he comes in contact, though the danger is greater in the period of desquamation—that is, as a rule, for not less than six weeks, and sometimes longer.

An important rule to follow in practice, but one often disregarded, is that all cases resembling scarlatina, but not absolutely recognizable as less dangerous diseases, must be treated as scarlatinal until the danger to the patient from complications, and to the community from contagion, has passed. Owing to the manifold appearance of scarlatina, the possibility of its occurrence must always be before the mind of the physician. Many individual cases and many disastrous epidemics have originated from anomalous cases, especially cases without eruption or with an eruption of an atypical character. The greatest caution is therefore necessary in all cases of sore throat to be on the lookout for other symptoms of scarlatina; and, on the other hand, the routine examination of the pharynx, by which means the exanthemata can so often be recognized at a very early period, should always be made as regularly as that of the tongue or the pulse.

Persons known to have been exposed to scarlatina, but not presenting symptoms, should be kept under observation for at least two weeks from the time of the last exposure; and children that have not had the disease and have been exposed should, if possible, be kept in one room for observation during the time specified.

Children living in a house in which a case of scarlatina is under treatment are usually prohibited from attending school, Sunday-school, or other public gatherings until the premises have been disinfected, but after the period of incubation has elapsed without the development of symptoms, if the patient is properly isolated, it would be proper, with the consent of the health-officers, to relax the quarantine of the suspect.

Many cases of scarlatina require only the most simple hygienic treatment; all must be watched until the patient is completely well.

The room and the arrangements for the patient should conform to the description already given. The room should in the beginning be darkened, or at least the patient should be turned from the light. The temperature should not be too high, 65° F. (18.3° C.) being usually sufficient, especially in the early part of the disease. The bed-clothing should be light. A nurse must be constantly in attendance. The temperature, pulse, and respiration, for the first few days, should be taken every two hours; later, not so often, but not less than three times in the twenty-four hours. The urine must be collected and measured every day.

Sometimes the case is recognized before the actual onset, from the appear-

ance of the sore throat, with or without a history of exposure. If so, the patient should be put to bed at once, and the symptoms of the onset be treated if necessary, but no active treatment should be instituted, as it would be very likely to interfere with the appearance of the eruption. When the eruption comes out slowly or irregularly, it can often be assisted by a hot foot-bath or by hot drinks. Often the case comes under the care of a physician only after the appearance of the rash and after the chill and vomiting of the onset. After this the stomach usually gives no serious trouble, but if vomiting continues, bismuth and lime-water, cracked ice, carbonated water, etc., can be used to control it. A calomel-purge may be given in the beginning if the bowels are confined. Often no cathartic treatment is necessary. Owing to the general indication for mild diet and to the additional danger of nephritis, only the blandest food and drink should be given. Milk is the best food, given in quantities as large as the patient can digest. After the early nausea and vomiting have ceased, the patient should be encouraged to drink water. In order to have the water taken freely, a pure so-called "mineral water" can be used, or one may prescribe a saline diuretic, to be given largely diluted.

Pharyngitis or tonsillitis should be treated from the beginning, but in mild cases only a mild antiseptic gargle is necessary—either potassium chlorate or dilute Dobell's solution. If the patient cannot gargle, the nasal douche must be used, with gentle cleansing of the pharynx from the mouth.

To relieve the itching of the early stage, and as a safeguard against the spread of the virus later through the scales, the skin should be kept soft by the use of some greasy preparation. Perhaps pure lard is as good as anything else, but vaselin seems pleasanter, and if the cost is no obstacle vaselin-cold-cream may be used. One of these substances should be rubbed in gently all over the body whenever the itching becomes marked; later, once or twice a day. I have never been able to see that carbolated ointments had a more marked effect on the itching than the unmedicated ones, and, relying on the mechanical action of the inunction, do not add an antiseptic for its probable action on germs. Greasing the skin seems to lessen the shedding of large scales, perhaps on account of their breaking under the friction. One advantage of the constant greasing is that there is less danger of breaking the skin from picking at the scales at a later period.

The patient should be bathed once a day, either in a full bath at between 98.6° and 100.4° F. (37°–38° C.) with gentle rubbing of the whole surface, or, if the full bath be impossible, by bathing the whole body (one part being exposed at a time) with water at between 100.4° and 105.8° F. (38°–41° C.) applied by means of soft cloths, which should be burned at once after use. After drying the body the vaselin or other ointment is to be rubbed in as before. This process of bathing and greasing should be continued until desquamation has ceased for several days.

In mild and uncomplicated cases, when the temperature reaches normal, farinaceous articles may be added to the diet. The patient must still be encouraged to drink water freely, and the temperature must be taken regu-

larly, any rise being made the signal for a careful examination for complications. The throat must be examined daily and the condition of the ears be inquired into.

The urine must be examined every day during the first week, not less than every other day during the second and third weeks, and twice a week during the rest of the stay in the house. Any marked fall in the quantity or the specific gravity, or a rise of temperature, calls for examination at once.

After the temperature has been normal for a week, if there are no complications and if there is no danger from drafts or exposure, the patient may sit up, warmly clad, but must not go out of the room. In cases in which, on account of youth or for other reasons, the patient cannot be trusted, it is safer to keep him in bed for not less than three, or better four, weeks. Six weeks, however, should be the shortest period for keeping the patient in his room, except in the mildest cases in warm weather; and in cases with complications or with traces of desquamation still in progress the time must be longer.

In severe cases of scarlatina there are many indications for treatment. I shall consider first those of a general kind or those due to the severity of the primary disease; in the next place the complications, most of which, it must be repeated, may be met with in cases mild in the beginning.

In all cases that begin with any severe symptoms, as diphtheric pharyngitis, or hyperpyretic temperature, or with severe delirium, convulsions, or somnolence, a bad prognosis must be made. The probabilities are that the case will prove a malignant one.

After a preliminary cathartic dose of calomel, vomiting should be allayed, and if diarrhea is excessive it must be treated with bismuth, opium, etc. Efforts must then be directed to keep up feeding either by the mouth or by the rectum. Stimulants, as wine, whisky, strychnin, caffein, etc., must be used according to the indications on the part of the heart or the general condition.

It is rather remarkable that in so common a disease as scarlatina there is not more definite agreement regarding the treatment of the fever. I do not refer to the cases in which, after the first day, the temperature falls to or below 103° F. (39.4° C.), but to those in which it remains constantly above that or ascends to points much higher. Although scarlatina was the first disease treated in modern times by cold bathing, by Currie, and although this procedure has now the advocacy of some of the highest authorities, there is still no settled belief as to the value of bathing, even without speaking of putting such belief into practice. There can be no doubt that this state of affairs is partly due to the indolence of the profession, as has been the case with typhoid fever, but it is chiefly due, I think, to the fact that scarlatina is so irregular, capricious, and insidious in its course that the effects of various forms of hydriatric treatment are difficult to analyze, and the best methods for various kinds of cases are difficult to formulate. As it is desirable to have more experimental work on the subject, I quote briefly some of the most experienced hydrotherapeutists, including those who use very different forms of treatment.

Leichtenstern[1] is one of the most enthusiastic advocates of cold bathing in scarlet fever. He prefers baths at from 62.6° to 68° F. (17°–20° C.), sometimes, however, as low as 59° F. (15° C.) or as high as 71.6° F. (22° C.). The patient is rarely kept in the bath longer than ten minutes. Leichtenstern holds that it is better to give baths of brief duration at short intervals in preference to protracted baths at long intervals. The indication for bathing, according to him, is the continuance of fever, and not its height. Delirium, somnolence, and coma, so far from contraindicating the bath, are improved by it, and the same is true of pneumonia, hypostatic congestion of the lungs, and nephritis.

Incidentally, Leichtenstern remarks that itching is not so severe in cases treated by bathing. The contraindications for bathing, according to this authority, are cardiac weakness and collapse or a tendency to collapse, especially when the internal temperature is high while the skin is cool. A rapid pulse in itself is an indication for, rather than against bathing.

One of the most extensive investigations in the use of water in scarlatina was carried out by Reimer of St. Petersburg,[2] who treated with various forms of hydriatric measures 978 cases among a total of 3460. He maintains that the fever is the best guide in prognosis, both in the course of the disease and in the complications. According to him, the prognosis is better the more rapid the fall of temperature. Cases in which the temperature reaches 105.8° F. (41° C.) with a severe chill, or cases with high temperature and repeated chills, are of absolutely hopeless prognosis.

Reimer used various kinds of cold packs, warm baths, gradually cooled baths, cool half-full baths, and full cold baths with friction when the temperature reached 102.2° F. (39° C.). The results with warm baths were bad, as were those with baths gradually cooled. The best results were obtained with baths at from 68° to 71.6° F. (20°–22° C.), or sometimes as low as from 59° to 64.4° F. (15°–18° C.), lasting from five to eight minutes; 363 cases were treated in this way. After the bath there was a fall of 3.6° F. (2° C.) or more, which lasted, however, but a short time. The greatest improvement was observed in the nervous symptoms, and this Reimer considers more important than the fall of temperature. According to both Reimer and Leichtenstern, complications do not contraindicate the cold bath.

In the United States we have the eloquent testimony of Hiram Corson, whose remarks I quote from the valuable work of Baruch:[3] "In a practice of fifty-nine years . . . . no means ever used by me or known to me as used by others in scarlet fever have so successfully warded off its blows and shielded patients from harm and restored them to health as the use of cold water and ice."

Although others could be quoted in favor of the cold bath, perhaps a greater number advocate warm baths or gradually cooled baths. Ziemssen, for example, prefers a bath beginning at 89.6° F. (32° C.) and gradually cooled to 71.6° F. (22° C.).

[1] *Deutsche medicinische Wochenschrift*, 1882, No. 45 *et seq.*

[2] *Jahrbuch für Kinderheilkunde*, 1890.

[3] *The Uses of Water in Modern Medicine*, vol. ii. p. 173.

Henoch[1] recommended the application of ice-bags to the head and the administration of medicinal antipyretics (see p. 168) or warm baths (87.8° F.—31° C.). He advised against colder baths very strongly, for the reason that "in scarlet fever, in which there is a more marked tendency to collapse from cardiac weakness than in other diseases, the application of cold may lead to very rapid collapse." Henoch recommended, therefore, as safer, cool bathing of the whole body every two or three hours with a sponge soaked in water and vinegar. His objection to systematic bathing does not seem altogether reasonable. He held that the cases cured under antipyretic treatment were only apparently malignant, the symptoms being due to the fever; that in genuine malignant cases even cold bathing reduces temperature only temporarily and slightly, while the pulse remains small and the general depression is greater. For such cases he advised the use of stimulants only, "so as to sustain the heart until the organism has survived the severe consequences of the infection."

My own experience with cold bathing in cases of scarlatina has been too limited to permit a dogmatic statement. It is my belief that in a case suspected strongly to be malignant it is better to at least try the effects of cold bathing, not neglecting stimulants, of course, when indicated by heart and pulse. There is reason to believe, however, that warm or gradually cooled baths are of considerable value in scarlatina. As an example the following case reported by the late Juhel-Rénoy,[2] one of the most enthusiastic French advocates of hydriatric treatment, is of interest: The patient, a child five years old, in the course of an attack of scarlatina had convulsions, with delirium and drowsiness. The temperature was above 104° F. (40° C.), and for twelve hours there was suppression of urine. The patient was put in a bath at 78.8° F. (26° C.) and cold affusions were made to the head. After six minutes shivering began; the child was then put to bed, and in half an hour was asleep. Baths were continued on the following day. After the first bath delirium disappeared entirely; on the next day the secretion of urine recommenced; and in a few days recovery was complete.

Carslaw[3] recently gave the results of the treatment of 630 cases of scarlet fever by means of cold and tepid bathing. He concludes that "in the large majority of cases baths are not required. Even in simple cases and in anginous cases tepid spongings are useful in allaying restlessness and giving comfort. If the rash has not developed, the addition of mustard is an advantage. Mustard-spongings are particularly useful during the earlier stages of an attack in which nervous phenomena are prominent."

Baruch[4] gives the following directions, which are eminently safe: "Unless the temperature is above 104° F. (40° C.), no bath under 85° F. (29.4° C.) should be used. If the patient is restless, a tepid bath is useful, especially if it can be prolonged for half an hour without exciting the patient too much. When, in the beginning of the disease, there is a rapid rising temperature with

[1] *Vorlesungen über Kinderkrankheiten.*
[2] *La Semaine Médicale*, 1894, p. 62.
[3] *Glasgow Medical Journal*, Nos. 1 and 2, 1894.
[4] *Op. cit.*, p. 169.

mottled skin, or a tardy appearance of the eruption with a rapid pulse, cyanotic nails, or convulsions, there is no measure that affords such positive relief to the nervous system which is overcome by the toxemia as a cold affusion or a dip-bath. Held naked in a tub containing twelve or fifteen inches of water at 100° F. (37.8° C.), several buckets or pitchers of water at from 75° to 80° F. (23.9°–26.6° C.) are thrown over the head and shoulders; the body is then well rubbed and the patient put to bed. The result is usually at once apparent in an improvement of all symptoms. As the relief may be of short duration, the treatment should be repeated every two or three hours. When the temperature is high, the pulse rapid, and pulmonary complications are threatening, we have, in the graduated bath, from 90° to 70° F. (32.2°–21.1° C.) for ten or fifteen minutes, with friction, an invaluable remedy which, once judiciously tried, will give the attendants and friends sufficient confidence to overcome the invariable objections of the patient. It should be repeated every three hours if the temperature indicates it. The bath may be of shorter duration and be repeated more frequently. The rule is, in case of collapse or of adynamic or nervous symptoms, to use cold affusions or a dip (not over 70° F.—21.1° C.) quickly applied; for high temperature, etc., longer baths at from 70° to 90° F. (21.1°–32.2° C.) with gentle friction or the wet pack."

From what has been said I think the great value of hydriatric treatment can be appreciated, and the minor differences will no doubt receive sufficient explanation when larger statistics have been furnished.

Though the routine administration of antipyretic drugs in scarlatina has no justification, it may in some cases seem desirable to produce a temporary effect, and for this purpose my own preference is for phenacetin, given in doses of $\frac{1}{2}$ grain (0.032) for each year (though seldom, even to adults, administering more than 2 grains—0.13) every hour or two until the desired effect is produced. I rarely give more than two doses.

In the essentially malignant cases of scarlatina, with the eruption marked all over the skin, and on the mucous membranes, and with symptoms of intense general depression, antipyretic drugs would only add to the danger. In these cases cold baths should be used, as already described. At the same time stimulants, such as wine, whisky, or strychnin, should be given, the last especially, in full doses hypodermically. Finally, ether or camphor may be injected hypodermically.

In the less severe cases, when the pulse becomes unduly weak, frequent, or irregular, or when there is other evidence of enfeebled circulation, such as cyanosis, strychnin should be used hypodermically, in a dose sufficient to keep the pulse regular.

Restlessness and delirium, when not relieved by the ice-bag or the bath, call for the administration of bromids, which are best given in full doses—from 30 to 60 grains (2.–4.) of the potassium or sodium salt in one dose, in a glass of water, usually at night. This mode of administration is better than giving smaller doses repeatedly, and to a child 30 or 40 grains (2.–2.6) can safely be given. For sleeplessness a full dose of sulfonal should be given,

dissolved in boiling water and swallowed when sufficiently cooled; or chloral can be given combined with bromid.

**Angina.**—The reasons for maintaining cleanliness of the pharynx have already been mentioned, but in many cases of scarlatina it is necessary to treat inflammations in that region.

The discussions and investigations regarding the scarlatinal anginas have resulted in the knowledge that these are of many and different kinds. Although efforts to establish the relation of pyogenic cocci to the primary disease have failed, the importance of these organisms in the causation of the anginas is now well established. In addition to these, however, the common organisms of the catarrhal anginas of various grades, from the mildest to the necrotic or phlegmonous forms, and the occasional participation of the organisms of diphtheria, must not be lost sight of. While the near future is certain to enlighten us regarding the rapid recognition of the different forms and their occurrence in different cases, we must for some time treat all, or most of them, according to the results of experience. In the milder cases antiseptic gargles, douches, swabs, and sprays must be used, potassium chlorate or carbolic acid or some similar solution being usually selected. The old combination of potassium chlorate and ferric chlorid sometimes seems more effective than the simple, saturated solution of the potassium-salt, but the gargle must not be swallowed. In some cases it is useful to combine an aromatic substance with the solution.

In the severer cases of angina more vigorous treatment is necessary. In tonsillar cases the injection of carbolic acid into the affected tissue, as advocated by Heubner, yields excellent results, as I have had an opportunity of witnessing in Prof. Heubner's wards. A 3 per cent. solution is injected by means of a special needle which penetrates only a short distance into the tissues. But the best remedy in the severe cases, in my opinion, is hydrogen dioxid, for the recommendation of which we are indebted to Williams, according to whose latest paper[1] one can use a 25-volume solution in a spray, and a 50-volume solution as an injection or on swabs. The use of the dioxid should be preceded by an application of cocain. Applications should be made every four hours during the night, and more frequently during the day. The glass syringe and the glass swab devised by Dr. Williams should be used. Like other operations on the pharynx, these must always be performed with the greatest care and gentleness. Children especially are often difficult to treat on account of their intolerance of such manipulation, and it is important to begin early, so as to induce a certain amount of tolerance. Struggling on the part of the patient should never be allowed to occur. If there is obstruction to breathing, the use of vaporous inhalations can often be resorted to with advantage.

If there is inflammation in the nares, this should be treated locally by douches. On account of the ease of irrigation, milder solutions can be used, such as dilute Dobell's, carbolic-acid, or boric-acid. The solution should be warm and delivered from a reservoir not more than a foot above the head.

[1] *American Journal of the Medical Sciences*, Nov., 1893.

Children that cannot stand the douche can have the nares washed out by passing the solutions slowly through a soft-rubber syringe.

**Otitis.**—As otitis media or interna is the result of extension of disease from the pharynx, the value of local preventive treatment directed to the mouth, the pharynx, and the nares must be obvious. Careful treatment of these cavities would greatly lessen the large number of cases of deafness due to scarlet fever and measles. But the ear-complications cannot be prevented entirely, owing to the practical difficulties encountered in treatment, and the physician who takes care of a case of any of the eruptive fevers must have at least enough experience in otology to enable him to make an examination of the ear and to perform paracentesis. This remark is especially applicable to those who have not a specialist at hand in case of need. If symptoms of otitis, such as pain in the ear, tinnitus, deafness, etc., appear, an examination of the external ear and the membrana tympani should be made. The local treatment of the pharynx must be continued. In many cases a few drops of chloroform dropped into the external auditory canal and allowed to evaporate will cause rapid subsidence of pain and will apparently check further trouble. If the pain continues, a solution of morphin in glycerin (1 : 8) should be dropped into the canal and a pledget of cotton be placed loosely within the meatus. Hot applications externally afford great relief. One can use the hot-water bag, which is usually most convenient, or a hot hop-bag. In cases with very severe and localized pain leeching is often useful. The glycerin-and-morphin solution should be renewed as it becomes absorbed. In some cases the symptoms subside at this stage, but in all cases the tympanic membrane must be examined daily, and on the appearance of redness and swelling of the membrane an incision should be made. After this the disease is to be treated according to the rules of otology, by washing carefully with warm boric-acid solution and insufflating boric acid, together with the other methods employed in such cases.

**Adenitis.**—Although inflammation of the cervical glands often occurs in cases of severe angina, and so seems to depend on the severity of the throat-lesions, it may also occur in cases with insignificant visible changes in the pharynx. When the glands become swollen, it is useful to make cold applications, as of a rubber bag or bladder filled loosely with finely cracked ice and corn-meal or bran. If this does not give relief, it is better to discontinue the cold and to use applications of belladonna and glycerin protected by cotton wadding. Even in cases apparently most severe, suppuration often does not occur, so that one should hesitate to encourage the process by the use of hot applications, such as poultices. When evidences of pus are present, an early incision should be made and the treatment be conducted on antiseptic principles. In some cases, however, I have thought I prevented suppuration by injecting from 1 to 3 drops of pure carbolic acid into the enlarged gland; as this procedure usually relieves pain, it can be practised early with advantage.

**Nephritis.**—Not only on account of its immediate danger during the acute

stage, but also on account of its remote consequences years afterward, nephritis is justly looked on as one of the most important complications of scarlatina. Though it usually appears toward the end of the disease, in the third or fourth week, it may come on very early. Although usually a manageable affection, it may cause death in a remarkably short time; or it may leave the patient with more or less severe parenchymatous nephritis, or it may lead to chronic alterations in the kidney that occasion symptoms long afterward and then induce a fatal result. The early recognition of renal alterations, therefore, is of the greatest importance.

The presence of albumin in the urine is almost the rule in scarlatina. In most cases, however, the amount is very small, so small, indeed, that only traces are shown by the careful employment of the heat-and-nitric-acid test, or somewhat more plainly by the overlaying (Heller's) test or the acetic-acid-and-potassium-ferrocyanid test. This condition is, of course, merely the so-called "febrile albuminuria," but it is frequently associated with the presence of hyaline casts, an increase of small cells in the urine, and sometimes with a few red blood-corpuscles.

The amount of albumin should never be relied upon as a guide to the existence or non-existence of nephritis or degeneration of renal epithelium; that is, the absence of more than a trace of albumin does not always indicate the non-existence of profound renal disease. In a considerable number of cases, in different epidemics, I have found that serious renal disease may, and often does, develop with minimal traces of albumin. In several cases, with much blood and numerous epithelial casts and blood-casts there was in the beginning no more albumin than the blood would account for. In one case in particular, fatal uremia occurred, although the urine was examined chemically, every day for some time beforehand, and contained only a trace of albumin together with many casts such as are found in severe acute intoxications—epithelial, waxy, hyaline, etc. In most cases of this kind the urine after a few days contained large quantities of albumin and presented other characteristics of the renal secretion of cases of acute nephritis.

Nephritis is more likely to occur in cases in which exposure to cold or to drafts has taken place. In fact, if such exposure takes place early, an attack of nephritis may be predicted with almost absolute certainty. In the mixed epidemic of scarlatina and rubella already mentioned, I found thirty cases of severe acute nephritis within two or three weeks of the outbreak. The cases being mild and the weather warm, the patients, all children, were allowed to play out of doors as soon as the fever or the rash had subsided, and most of them developed edema, and many of them bloody urine, before desquamation was well established.

On the other hand, the greatest care will not absolutely prevent the occurrence of nephritis in scarlatina, and the oft-quoted statement of Jaccoud, that in fifteen years he had never had a case of scarlatinal nephritis, in consequence of adhering to a milk-diet and exercising great care, might be used unfairly to the discredit of some very careful physicians.

In scarlatina efforts should be directed to avoid nephritis by the use of a bland diet, by care to prevent chilling (most conveniently by keeping the patient in bed not less than four weeks), and by the prevention of secondary infection.

As an additional precaution, the urine must be examined frequently; the following method, which I have used in private practice for some years with great advantage, and which is not so difficult to carry out as might appear at first glance, has often been of great service. In hospitals, of course, the usual methods are quite sufficient.

The nurse is furnished with a bottle large enough to contain the urine passed in twenty-four hours, with graduations marked on the outside, so that the quantity can be measured. The daily amount is noted on the bedside-chart. Every day a specimen is taken for examination, in a clean bottle, mopped on the outside, after filling, with a solution of mercuric chlorid. The usual examination as to specific gravity, color, etc. is made, but the microscopic examination of the sediment is considered the most important part.

In the febrile urine, as has been said, casts are found along with traces of albumin. The casts are hyaline and are usually narrow. A few epithelial cells may be found on the casts or free, and at times blood-corpuscles also. An excessive number of epithelial elements or of blood-corpuscles should always lead to a closer watch for renal complications. In cases in which the results of chemic investigation of the urine during the period of eruption are slight or negative, microscopic examination need not be made every day, but only every other day up to the end of the third week. After that, examination should be made twice a week up to the time of the patient's discharge. But in any case, if there is a marked fall in the amount of urine, or if the specific gravity falls without a diminution of the amount, careful chemic and microscopic examination must be made repeatedly.

Whenever a marked fall in the amount of urine or in the specific gravity occurs, or whenever large numbers of epithelial casts, or free epithelium, and many blood-corpuscles or blood-casts appear, or when more than traces of albumin are present, even if headache, increased pulse-tension, edema, vomiting, etc., are absent, the patient should be put on special treatment. If not already in bed, he is at once to go to bed, with blankets above and below him, or at least with woollen night-clothes. The diet is to be of skim-milk, with pure water as a beverage. In the beginning a warm bath (from 100.4° to 105.8° F. —38°–41° C.) should be given and sweating encouraged, and the bath should be repeated every day. At this stage I give the patient nitroglycerin, usually in the dose of gr. $\frac{1}{100}$ (0.00065) every three or four hours. Although the other measures named are perhaps sufficient, my experience has led me to believe that the nitroglycerin is of unmistakable value.

The bowels, if confined, should be moved by a dose of from 5 to 10 grains (0.32–0.65) of calomel followed by a saline.

In many cases, even with an abundant sediment of blood and casts, and with or without the presence of large quantities of albumin in the urine,

the patient will under this treatment slowly progress to recovery without any but the mildest uremic symptoms, if any.

For the latter, however, the physician must always be prepared, and at the first approach of such symptoms as vomiting, headache, delirium, spasms, or convulsions, a hot-air bath should be given, to induce free sweating. In private practice the easiest way to do this is to make a sort of tent between the foot of the bed and a chair by means of a blanket or a coverlet. The bedclothes are to be raised by hoops or sticks, and the space thus created should open into the tent at the foot of the bed. An ordinary lamp is then lighted and placed on the floor under the improvised tent. Almost at once the hot air surrounds the patient, around whose neck the covers are well tucked in. Sweating usually begins very soon, and can be assisted by having the patient drink a glass of hot lemonade.

The treatment of fully developed scarlatinal nephritis does not differ from that of nephritis arising from other causes, and is described elsewhere.

After recovery from scarlatina, with or without evidences of renal disease, the patient or his relatives should be informed of the possibility of late symptoms, so that the urine can be examined carefully at longer or shorter periods, according to the character of the attack.

Arthritis, synovitis, and thecitis are best treated by applications of laudanum and belladonna with cotton compresses. In the case of inflammation affecting joints, the parts should be kept at rest by means of suitable splints. Salicylates usually have a good effect in these cases, but the external treatment should be used first, and the salicylates be given with due regard to their irritating effects on the kidney.

The most difficult part of the treatment of a case of scarlatina is often that after the fever and rash subside, because of the desire of the patient to be out, and the difficulty of impressing on him and his relatives (in many cases, too, on the nurse) the danger of the complications that may still occur. Besides this, there is the difficulty of enforcing isolation. The temperature should be taken three times a day as a guide to the onset of complications. The patient must be kept in bed for three or four weeks, according to the severity of the attack and the season of the year, but the greatest care must be taken to see that he is not exposed to drafts or cold. The diet must remain mild, milk being continued, but later on cereals, gruels, broths, and meat may be added. A daily warm bath—either a full bath or a sponge-bath—should be given, followed by an inunction of vaselin or other ointment, especially upon the soles of the feet and the palms of the hands, where the large hard scales often cause great irritation.

I cannot see the advantage of adding to the grease agents to hasten desquamation, such as salicylic acid. The use of soap, even soft soap, in the bath for that purpose cannot be objected to, but surely there is no advantage in using some of the other remedies that have been proposed, as there is seldom, in northern latitudes, any disadvantage in keeping the patient in the house during the whole time of natural desquamation. So far as prophylactic action can be

attributed to the salicylated inunctions, there is no reason to believe that they are of any more value than the vaselin (or lard) alone.

As scarlatina is a disease that gives rise to more or less anemia, it has become customary to administer iron during convalescence—a practice of undoubted value. The form in which the iron is given does not seem to be a matter of great importance. Preparations of the tincture of the chlorid, such as Basham's mixture,[1] are very useful, as is also Blaud's pill.[2]

If appetite does not return, the use of the bitter tonics, such as the compound tincture of cinchona or the elixir of calisaya, tincture of calumba or tincture of gentian, is of great value.

Toward the end of the sixth week in most cases, but only when desquamation is ended, the patient should be given a final thorough bathing, in which the scalp should receive special attention. He may then put on disinfected or fresh clothing and be moved into another room; the old one is to be disinfected according to the rules laid down in an earlier section.

## Measles.

Concerning measles, even more than scarlatina, the public requires education in the knowledge that it is by no means the trivial and harmless disorder it is often considered. Even in mild cases want of care may result in serious danger during the acute stage, or lead to a complication that may be fatal, or leave the patient with some serious chronic disease. Every case should therefore be seen by a physician as early as possible and should be cared for by an experienced nurse.

The sick-room should conform to that described for cases of scarlatina, and precautions should be taken to limit the spread of the disease as in the case of scarlatina.

It is true that in some places the notification of measles is not required, but this omission is certainly a mistake. It is also true that many people, including some physicians, believe in exposing children to others with measles, "in order to have it over with." Such a course is a great mistake. Although the predisposition to measles is very great—so great that in asylums the morbidity is sometimes 100 per cent.—it is possible to escape the disease, and a very efficient way to limit its spread is to limit exposure to it. The idea that adults who have measles suffer more severely than children cannot be proved to be true.

Although the diagnosis of measles is usually easy if the case has been seen from the beginning of the catarrhal stage, there are certain possibilities of error. Not to mention German measles, there are some cases of scarlatina in which the eruption in the beginning resembles slightly that of measles. Here the history of the onset usually suffices to make the diagnosis. Much more important are cases of small-pox, and one can only avoid dangerous error in such cases by careful examination of all the possibilities of infection, and by

[1] Mistura ferri et ammonii acetatis.

[2] Equal parts of dried iron sulphate and potassium carbonate.

watching the course for a few days, care being taken to institute such treatment, hygienic and otherwise, as will give the greatest protection to all concerned.

The room should be well aired, but the patient should be protected from drafts, and the temperature should be between 65° and 75° F. (18.3°–23.9° C.). In the beginning the room should be darkened, or at least the eyes should be protected from glare.

The diet should consist chiefly of milk, gruels, and broths, and the patient should be encouraged to drink cool water or mild acidulous beverages, but not cold water. In the beginning, however, before the rash has fully appeared, hot drinks seem to be of some value in "bringing out the rash." In cases in which the eruption is very tardy hot baths or mustard foot-baths should also be given.

Powerful antipyretic drugs are never necessary, though sweet spirit of niter or spirit of Mindererus may be given, well diluted, with benefit. If there is much redness and swelling of the conjunctiva, a saturated solution of boric acid should be applied locally every hour or two. To keep the pharynx clean mild antiseptic gargles should be used. Coryza, if severe, can also be treated with advantage, after the first stage, with warm, mild antiseptic solutions applied by a nasal douche or spray. When there is fulness of the nose or the throat, it is useful to have the air kept moist by vapor from a tea-kettle, a spray, or a similar apparatus; if the condition is severe, compound tincture of benzoin should be added to the fluid in the vaporizing apparatus. If cough is troublesome, the chest should be rubbed with camphorated oil or turpentine, and if it continues an expectorant mixture should be given.

Usually the skin does not give much trouble, but if there is itching the surface should be oiled with vaselin or some other ointment. Warm baths also give much relief. As desquamation sets in, bathing should be continued, inunction following the bath. After the temperature falls to normal the patient may get out of bed, but he should not leave the room for three or four weeks.

As a useful guide to complications during the febrile stage or later, the temperature should be taken at frequent intervals and a record be kept. Any irregularity during the early stage, or a rise of temperature later, should always excite suspicion of a complication and lead to a thorough examination.

In favorable cases the diet can gradually be brought to the ordinary kind as soon as the temperature falls. In cases of poor appetite or slow recovery tonics should be given.

**Complications.**—Bronchitis, if severe, should be treated by the use of expectorants in the beginning, with counter-irritation over the thorax. Combinations of ipecac, ammonium chlorid, and mistura glycyrrhizæ composita, or ammonium chlorid in water or in sirup of tolu, if there is no need of the more sedative and relaxing mixture, are useful in the early stages. Later, ammonium chlorid and potassium iodid in combination with sirup of tar or senega yield good results. If cough is very troublesome, ammonium bromid or codein can be added to the expectorant mixture.

With the first indication of capillary bronchitis or broncho-pneumonia a cotton jacket or a hot poultice should be applied to the chest, expectorants containing ammonium carbonate be given, and general stimulation with wine, whisky, or strychnin be carried out. If there is much dyspnea, with cyanosis, the patient should be immersed in a warm bath (from 95° to 100° F.—35.°–37.8° C.) and cold affusions be made to the head. In milder degrees of the same condition cold (60° F.—15.6° C.) sponging alone often produces remarkably good results.

In all cases complicated by severe bronchial or pneumonic affections the patient should be treated carefully until all signs of the disease have ceased and improvement in weight and strength has begun. Expectorants, counter-irritation of the chest, cold bathing, exercise, cod-liver oil, and nutritious food must be used according to the special indications, and in all cases in which expectoration continues beyond the usual time, examination of the sputum must be made for the detection of tubercle-bacilli or elastic tissue, and be repeated frequently if negative. In the more chronic cases change of climate may have to be prescribed.

Diarrhea should be treated in the beginning by a mild mercurial purge followed by a saline. The diet should consist of boiled milk and lime-water. If the diarrhea continues, bismuth should be given in 10-grain (0.65) doses after each stool. For more severe diarrhea powders containing 10 grains (0.65) of bismuth and 5 grains (0.32) of salol should be given, and if the purging is severe or if there is much pain, small doses of morphin (gr. $\frac{1}{20}$–$\frac{1}{12}$—0.0032–0.0054) should be added.

Convulsions, if due to high temperature, should be treated by the ice-cap, the cold bath, or full doses of bromids. The last, combined with chloral, can be given conveniently by the rectum.

Malignant cases with high temperature should be treated by baths at from 64.4° to 77° F. (18°–25° C.) for adults or from 68° to 80.6° F. (20°–27° C.) for children, each immersion lasting about ten minutes. If there is delirium, douches of colder water should be poured over the head during the bath. In this connection it is worth while to call attention to the experience of Corson, who, among thousands of cases of measles treated during sixty years, lost not a single one. Corson used frequent cold sponging and encouraged the patient to drink freely of cold water, but he gave no medicine.

Noma is one of the most serious complications of measles, and though it usually occurs in asylums or among cachectic subjects, I have seen one case in private practice in which there did not seem to be unusual debility, and in which there were no other complications, as shown by autopsy. Still, it cannot be doubted that general tonic treatment offers the best guarantee for its prevention, so that in all cases of measles convalescence should be hastened by bitter tonics, iron, and nutritious food, and the greatest care should be devoted to the mucous membranes and the skin. If symptoms of gangrene occur, the treatment must be surgical, either by the use of the actual cautery or of escharotics like nitric acid, or, what is perhaps just as useful, poultices to

hasten separation, and active antiseptic treatment of the ulcer. Diet of the most nutritious kind must be given, and general stimulation by wine or whisky, beef-tea, ammonium carbonate, cinchona, strychnin, etc., must be carried out.

The other complications of measles are to be treated as if independent affections.

Frequently in measles, especially among the poorer classes, the most important stage is that of convalescence. The patient should keep his room in winter or during cold weather for at least a month, or until all complications have subsided.

The disinfection of rooms occupied by patients with measles, of clothing and other objects exposed, the disposal of secretions and excretions or of cadavers, and the arrangements for funerals, must be conducted on the lines already described, although, as remarked among the general considerations, some of the measures need not be so rigidly carried out as in the case of scarlatina.

Children exposed should be isolated for at least two weeks; but it must be remembered that the stage of incubation is sometimes much longer. School-children in whose homes cases of measles are being treated are usually required to remain absent from school one month.

### Rubella; German Measles; Rötheln.

Rubella seldom requires anything but the simplest hygienic treatment. During the existence of the eruption the patient should remain in bed and take rather light diet. In the beginning a mild cathartic may be given, and, if there is fever, a saline diuretic mixture. If there is much itching, a warm bath, warm sponging, or application of vaselin will afford relief.

Isolation is usually recommended, but in the face of the well-known mildness of the disease it is usually difficult of enforcement and does not seem necessary. Care must be taken not to run the risk of non-isolation in a case at all doubtful, on account of the danger mentioned in speaking of scarlatina.

### Varicella; Chicken-pox.

Varicella is another disease that requires no special treatment in the large majority of cases. If there is much itching, applications of dilute carbolic acid (1 : 100) or of carbolated vaselin can be used. In severe cases or when the patient is delicate or sickly, he should be put to bed, a fever-mixture given, and local applications made to relieve the itching. Great cleanliness of the skin must be observed in the case of delicate children. Mild antiseptic washes locally, and tonic treatment internally, with quinin and iron, are useful in such cases.

### Small-pox; Variola; Varioloid.

Although the most important part of the prevention of small-pox consists in vaccination, and will be considered under that head, it is important to

remember that other things must be done in order to remove all danger of the disease. The virus of small-pox has a remarkable power of resistance, in the face of which it is a curious fact that, while we find a considerable number of enthusiasts who deny all efficacy to vaccination, and also many who have an equally blind faith in vaccination no matter when or how done, efforts to limit the spread of the disease by ordinary methods are not always so thoroughly carried out as they should be.

Small-pox is a disease which, more than all others, should be treated in special hospitals, perfectly arranged and equipped for the purpose, and so conducted that a physician who acquired the disease would wish to be treated there rather than anywhere else.

When small-pox occurs in a place where there is no special hospital, measures must be taken for carrying out treatment with complete isolation, if possible. It is sometimes possible to treat single cases in temporary buildings or in tents, and when this plan can be pursued it is perhaps the best. In such a case the room vacated by the patient must be subjected to rigid disinfection.

If the patient is to be treated in a dwelling-house, the precautions described as necessary in scarlatina must be observed. All persons known to have been exposed to the patient must be vaccinated at once, as must also every one who may directly or indirectly be exposed after treatment is begun, such as the family of the physician, etc. It is rarely possible to get nurses who are immune by reason of a previous attack of small-pox, but it must be arranged that unless there is evidence of successful vaccination within a safe period, the nurse must be vaccinated at once.

The physician treating a case of small-pox should have been vaccinated within a safe period or be vaccinated at this time. In visiting cases of small-pox it is well, if possible, to wear clothing different from that worn usually, and to visit such cases last of all. A long coat should be put on at the door of the sick-room and be taken off on leaving, and the most careful disinfection of the hands must be practised at the end of the visit.

Persons exposed, after having been vaccinated, must be kept under observation until the vaccination has run its course, or for at least three weeks, with the understanding, of course, that on the appearance of suspicious symptoms the individuals are to be isolated.

It is especially necessary in the management of a case of small-pox to have a fire in the sick-room or the anteroom, for the destruction of dressings, etc.

The most rigid precautions must be taken to avoid the transportation from the sick-room of infected material of all kinds.

The nurse should wear dresses made of material that can be washed, and which, before leaving the premises, must be either boiled for half an hour or soaked for not less than six hours in a solution of mercuric chlorid or of lysol.

The treatment of the case proper varies widely according to the severity of the disease. Mild cases, so-called "varioloid," need only to be kept in bed during the existence of the skin-lesions, and should be treated symptomati-

cally. Severe cases will require all of the care and all of the resources of nurse and physician.

After many kinds of more or less empiric treatment have been advised and tried, the conclusion has been reached, and will not easily be given up, that antiseptic methods must be used in a disease presenting lesions like those of small-pox; but the precise manner of carrying out antisepsis is not yet settled upon. Antiseptic treatment in small-pox has two objects—the prevention of secondary infection and the diminution of scarring.

With reference to the latter it has been said that no treatment will affect the pitting; but, except in so far as this statement refers to cases coming under treatment at a late period, it rests upon imperfect consideration of the circumstances. A certain loss of tissue must result in any case in which the papule reaches its full development and undergoes coagulation-necrosis. This, of course, cannot be prevented by any means as yet in our power. But in the large majority of cases the disfigurement from this alone must be very slight—so slight, indeed, as to be almost invisible, as an inspection of specimens illustrating this stage will demonstrate. The pitting that results in most cases is the result of suppuration and ulceration, so that there occurs a disfigurement having the same relation to an ideal result that the scar from a wound allowed to heal by suppuration has to one treated by antiseptic methods.

Recently an old method for the prevention of pitting has been revived; that is, the treatment of the patient in red light. It is well known that John of Gaddesden treated small-pox in a room lined with red, furnished with red hangings, etc., and this course was pursued to some extent up to the time of Bartholin, being given up as a useless piece of superstition by the skeptical but theoretic physicians of the eighteenth century. The method has recently been revived by Finsen and Svendsen, and a rational explanation, but one that needs confirmation, has been advanced. According to the modern plan, the patient is put into a room provided with windows of red glass, such as is used by photographers. However, even though the supposition that red light is inimical to the micro-organisms prove true, it is doubtful if treatment by this means will enable us to do away with the present method of dealing with such organisms—that is, cleanliness. Experiments with the use of red light in the treatment of small-pox have been made, but the results are not as yet such as to enable conclusions to be drawn from them.

For the purpose of limiting secondary infection and of lessening suppuration, cleanliness of the body and of the bed and the room must be enforced in the most scrupulous way. On coming under treatment the patient should have a full bath in warm water with soap, and undergo as careful a cleansing as if he were to be the subject of a surgical operation. The hair should be cut short in all except the mildest cases. The bed-clothing must be renewed frequently. All discharges must be disinfected and removed as soon as possible.

The care of the skin must be continued until the pustules have matured and the scales have fallen off. Bathing is one of the chief agents in this. Full baths at or near the temperature of the body should be given daily, or, if this

is not possible, the patient's skin must be bathed carefully by the use of wash-cloths and warm water. Sponges should not be used unless they can be cleaned thoroughly after each bath, as after surgical operations. An antiseptic can be added to the bath. As the simplest, vinegar or alcohol may be used; or boric or salicylic acid or corrosive sublimate may be added in proportions such as are used in surgery—that is, 1 or 2 per cent. solutions of boric or salicylic acid or from 1 : 10,000 to 1 : 5000 solutions of mercuric chlorid.

Other means of carrying out antisepsis have been employed, such as powders, pastes, or lotions, and these are of undoubted value, though they should not be used to the exclusion of the bath. Powders are the least useful. Pastes or lotions, on the other hand, are very convenient as dressings for the face or the hands in order to prevent scratching. Lotions of boric or salicylic acid can be applied on gauze or on patent lint, and pastes can be used in the same way. As a useful formula that of Lewantaner can be recommended:

℞ Glycerini, 70;
Amyli, 30;
Acidi salicylici, 3.—M.
Ft. pasta.

For the face a mask should be cut out of gauze (several thicknesses) or patent lint, and be applied after being smeared with the paste. Strips of lint smeared in the same way should be applied upon the hands, and when there is much itching the hands should be kept loosely bandaged.

For the itching and the feeling of tension of the skin, warm baths continued for an hour or more are useful, and in the stage of suppuration prolonged medicated baths are of value, though great care must be taken to prevent accidental swallowing of the water.

The old methods of limiting pitting, such as touching the pustules with silver nitrate, carbolic acid, etc., have been properly abandoned, although in cases presenting very few pustules they can be used. A number of newer methods have been proposed for severe cases. Talamon, for example, proposes to spray the parts with mercuric chlorid dissolved in alcohol and ether in the proportion of 2 per cent., repeating the procedure three or four times daily. During the spraying the eyes must be protected by pads soaked in boric-acid solution. This and similar methods are quite as tedious of application as the baths, and probably are much less efficacious. Modern surgical simplicity, rather than the cumbersome methods of former days, should be imitated.

The methods detailed should be practised until the scabs have fallen off, after which carbolated or salicylated vaselin should be rubbed upon the skin after the daily bath.

In almost all cases the use of an antiseptic gargle will be valuable. In the early stages, attended with a feeling of fulness in the pharynx, hot gargles should be used. The sense of fulness in the mouth and the pharynx should

also be relieved by cool drafts, such as flaxseed-tea or slippery-elm tea, or by letting the patient suck bits of ice.

In severe cases the conjunctiva and the nose will also require antiseptic lotions, especially boric acid. Careful antisepsis will prevent or lessen the severity of the eye-lesions, but the eyes must be watched carefully in all cases, and complications should be treated by appropriate methods.

Although I have spoken first of the external treatment, organs other than the skin require careful management. In the beginning a mild purgative should be given. The diet should consist entirely of bland liquid or semi-liquid articles. Milk, boiled and diluted with lime-water or with Apollinaris water, thin soups, gruels, eggs, etc. should be given in quantities as large as the patient can take and digest. It must be remembered that in severe cases lesions are present on all the digestive and respiratory mucous membranes, and as a result swallowing is often a difficult and painful process, so that the diet must be as bland, but at the same time as nutritious, as possible. The bowels should be kept open by the use of simple enemata.

If diarrhea occurs, it should be treated by mild doses of calomel followed by bismuth, or by bismuth and salol in chalk-mixture.

Edema of the pharynx or of the larynx requires the use of inhalations such as the compound tincture of benzoin, emetics, scarification, or, as a last resort, tracheotomy.

For fever the baths are most efficacious; and the consequences of the fever, or of the infection, such as delirium, restlessness, and sleeplessness, are also benefited by bathing; but if they persist in spite of the baths, bromids, chloral, sulfonal, or opium must be used in appropriate doses, singly or in combination, according to the aspect of the case.

For weak heart the usual remedies, such as strychnin, alcoholics, etc., must be used.

In hemorrhagic cases stimulants must be used. Of the various remedies recommended, quinin and tincture of ferric chlorid may be used for their stimulating effect, but ergot, so often recommended, is of doubtful value. Turpentine has, perhaps, some value in these cases.

During the stage of convalescence the patient should have tonics, with iron and nutritious food. The baths must be kept up, and the greatest care should be taken to treat any undue suppuration, or abscess or erysipelas, at its earliest appearance. The patient, not too warmly clad, should be encouraged to get up and take such exercise as the room permits.

The shedding of the scabs can be hastened by the use of soft soap in the bath or of a salicylic-acid solution. After the lesions have healed entirely the patient should take a full bath with soft soap, and after complete cleansing of the whole body, including the scalp, should put on clean clothing and be moved into another room. The sick-room must then be disinfected in the most rigid manner, as previously directed.

## Vaccination.

The clinical proof of the value of vaccination is so conclusive that our ignorance of the real nature of the vaccine-virus may seem of little practical importance. Nevertheless, for scientific reasons alone it is to be hoped that investigations into the nature of the material will soon clear up the matter, and it can hardly be doubted that important gains for practical medicine will thus result.

Although Jenner's prophecy that small-pox would be stamped out by vaccination seems far from realization, in that small-pox still exists, and sometimes to an alarming extent, yet it is not difficult to see that this fact does not in itself prove Jenner's contention absurd, as it cannot be maintained that vaccination has been carried out to an adequate extent, except in very few countries and for a comparatively short period. Certainly there are few—none with sufficient experience—who would deny the statement of Welch,[1] that "with perfect vaccination in infancy, and revaccination at puberty, Jenner's prediction as to the power of this agent to extirpate small-pox from the globe would soon be realized."

**Material used for Vaccination.**—At the present time, in the United States, animal lymph is used almost entirely. Although it has the disadvantage of being somewhat slower in action than human lymph, the fact that it can be obtained in any quantity and at short notice, and that it is usually of good quality, explains the reason for its preference.

The commonest form in which the lymph occurs is that of the so-called "points," slips of celluloid on the sharpened end of which the lymph is dried. These yield good results and have the great advantage that only an ordinary scalpel or bistoury is necessary in their use. On the other hand, it is very doubtful whether, when these points are used, the results are as good as with some of the other preparations. In our ignorance of the active constituent of the virus it is difficult to settle this question satisfactorily, the clinical evidence so far available being rather equivocal.

It is occasionally possible to use humanized lymph, and when the opportunity exists advantage can be taken of it. The person furnishing the lymph, preferably a child, should be of good family history, especially as regards syphilis and tuberculosis, and in vigorous health. The lymph should be taken on the eighth day, from typical unbroken vesicles without evidence of inflammation around the base. The lymph should be used by the arm-to-arm method, having all the persons to be vaccinated present with their arms prepared, and the whole operation should be aseptic. The lymph can, however, also be kept in capillary tubes or dried on points.

**Method.**—It must be remembered that vaccination is a serious operation intended for a definite and important purpose. It should be performed with the greatest care, and with even more than the usual precautions now accepted as necessary in minor operations. There is no doubt that the careless perform-

[1] *New York Medical Journal*, March 17, 1894.

ance of vaccination upon a large scale has resulted in much harm to patients and to the vaccination question.

The best site for vaccination is the upper arm, on the outer side, near the insertion of the deltoid muscle. Vaccination on the thigh or the leg is attended with more risk of complications from traumatism than when performed on the arm, but the former is sometimes necessary.

The field of operation must be cleaned thoroughly with soap and water. It is doubtful if antiseptics add to the value of thorough rubbing with soap and water. The seat or seats of the intended vaccination are then to be scraped gently with the sharp edge of a clean scalpel or bistoury until the moist surface of the rete Malpighii is exposed, but in such a way as to avoid bleeding. In the meantime the point of the vaccine-slip is to be moistened with a drop of cool sterilized water. The point is then smeared upon the scraped surface by applying the flat side of the slip, and the lymph rubbed into the abrasion, in which three or four lines are drawn at right angles to each other with the extreme point. For a primary vaccination two such spots should be made; for revaccination one usually suffices. In a few moments the lymph dries, and the surface should then be lightly covered with a thin pad of sterilized gauze or cotton fastened by narrow strips of adhesive plaster or by collodion.

If the vaccination pursues its normal course, no special treatment will be required. The patient can follow his usual pursuits, and bathe as usual, in the latter case taking care not to rub the sore. As a precaution, pure vaselin may be smeared over the spot before bathing. The various bandages made for the purpose of protecting the seat of vaccination are usually unnecessary. In special cases bandages can be improvised. If the gauze becomes soiled by secretions, it should be changed; and if the vesicles break, the dressing should be renewed, the sore being carefully cleaned and sprinkled with powdered bismuth or with a powder of boric acid and salicylic acid.

**Course of Vaccination or Vaccinia.**—During the first three or four days nothing of note is apparent about the point of vaccination. The slight redness that immediately follows the operation usually speedily subsides. On about the fourth day a slightly red papular elevation appears, and this during the next two days gradually becomes vesicular. On the fifth day one can see the umbilication surrounded by a pearly zone. Around this is a red zone, the *areola*. There is slight induration about the vesicles. These characteristics become more marked during the next day, and by the seventh or eighth day the *vaccine-pustule* is fully matured. It is then rather large and flattened, and presents well-marked umbilication, is of a glistening whitish color, more transparent at the edges, and with a bluish shimmer. The border is sharply circumscribed from the surrounding skin, which is bright red for some distance. During the eighth and ninth days the lesion becomes larger and less transparent; the areola is well marked and slightly indurated. The regionary lymphatic glands are often enlarged. During the next two days the process subsides, and by the end of a fortnight the scab becomes dry, dark brown, and hard. It falls off in the course of a week or two more, leaving a pitted, dark-

red cicatrix, gradually becoming paler, but never disappearing completely. The typical scar is well described by Welch, as follows: "It is distinctly excavated, with well-defined margins, reticulated or foveated, and altogether presenting the appearance of having been stamped into the skin by a sharply cutting die."

The general symptoms of vaccinia appear at about the end of the first week. They are usually mild, consisting of restless sleep, headache, and nausea or diarrhea; often they are absent.

Von Jaksch[1] and Peiper[2] have studied the phenomena of *vaccinal fever*, which comes on in some cases between the fourth and sixth days. Sometimes there is a primary fall of temperature. The fever is remittent, and may attain a maximum of 104° F. (40° C.), though usually it is much lower. Pulse and respiration are slightly increased in frequency. The fever lasts from two to four days and then falls gradually. The urine usually does not contain albumin.

Not every vaccination follows the local course described. The process is sometimes slow in course, not beginning to show the characteristic symptoms until the end of the first week or even later. On the other hand, it is sometimes so accelerated that the stage of suppuration is present by the seventh day.

When subcutaneous vaccination is practised the cutaneous lesions do not appear, although protection may be obtained. If vaccination is practised in an immune person, the characteristic symptoms do not appear. There is often considerable inflammation with great itching, sometimes a small papule surmounted by a vesicle, and later a pustule, without umbilication. By some it is said that the contents of such pustules are capable of producing typical vaccine-lesions in susceptible persons.

**Complications.**—In certain cases vaccination is attended with results not looked for, either in consequence of fault in the technic, of infection afterward, or of some morbid condition of the patient.

Rare eruptions have been described under the name of "vaccinides;" these are roseolar, miliary, scarlatinoid, lichenoid, urticarial, or generalized vaccinia. The last is the most important, but is very rare. It may occur in persons with dermatoses, or in perfectly healthy persons, but it usually occurs in infants vaccinated for the first time. The vesicles appear in various parts of the body, at the same time as those on the arm or preceding these, and are associated with more or less fever. If the eruption is extensive and the temperature is high, or if there is hemorrhage (epistaxis), death may occur.

Vaccination, as a rule, pursues an unmodified course in syphilitic subjects, but in cases presenting great cachexia gangrene may occur at the seat of operation. Dermatoses, especially eczema, are sometimes complicated after vaccination by generalized vaccinia attended with fever, vomiting, and nervous symptoms, and sometimes, it is said, terminate fatally. The diagnosis in these cases is difficult. They may simulate syphilis, or even small-pox. It must also be remembered that vaccination often aggravates an existing dermatosis or

[1] *Jahrbuch für Kinderheilkunde*, Bd. xxviii. [2] *Zeitschrift für klinische Medicin*, Bd. xvii.

provokes one in a predisposed subject. On the other hand, dermatoses are often seen to improve after vaccination, so that by taking all the necessary precautions for lessening the danger of complications one can vaccinate during an epidemic with little fear of the consequences.

*Accidents due to secondary infection* are much commoner and much more dangerous than the complications already named. In some cases a pustular eruption appears, the lesions of which do not become very large and usually do not cause alarming symptoms. This condition may result from contamination of the lymph, but more frequently it is due to faulty technic (dirty skin, instruments, or hands, or careless vaccination). Sometimes the ulcer becomes large, with an indurated base. Sometimes it resembles a chancre or a chancroid, but it can usually be distinguished by its shorter period of incubation and its more marked suppuration. It has a large inflammatory areola and is attended with enlargement of the lymphatic glands. In some cases the inflammation is phlegmonous from the beginning and accompanied by symptoms of sepsis. Such cases may terminate fatally.

Erysipelas may occur at any time as a result of infection. The occurrence of tuberculosis as the result of vaccination has never been demonstrated conclusively, and, though possible, must be extraordinarily rare. Tetanus has been seen to follow vaccination (Fruitnight). The possibility of inoculating syphilis in vaccination has been demonstrated, but, of course, can occur only with the use of humanized lymph from a syphilitic. The use of bovine lymph obviates the slight danger of such an occurrence.

Immunity to vaccination is extremely rare, and immune persons are observed in inverse proportion to the thoroughness of vaccination. The immunity conferred by vaccination is not permanent, although Jenner so supposed, and many still seem so to believe. Its duration seems to vary in different subjects, depending to some extent on the quality of lymph employed and the perfection of the operation.

Layet gives the following figures for successful revaccination at different ages: From six to seven years, 40 per cent.; from seven to eight, 42 per cent.; from eight to ten, 43 per cent.; from ten to twelve, 44.5 per cent. At the age of military service the proportion is from 60 to 80 per cent. (from 82 to 84 per cent. according to Pfeiffer). According to Meyer, in Germany 94.2 per cent. of all revaccinations are successful. The proportion in which revaccination is successful in those who have had variola is from 24 to 25 per cent.

In general, the protecting power of vaccination is lost within from six to ten years, and more rapidly during the period of rapid growth and in persons who have passed through severe sickness or alterative courses of treatment. The practice observed in Germany of revaccinating about every six years up to the age of eighteen or twenty, or at times of unusual exposure, is a very safe one to imitate.

The belief held by some, especially by many English authorities, that the efficacy of vaccination is proportionate to the number of scars is not held by many French or German writers, and does not seem rational. The extensive

experience of Welch of Philadelphia leads him to make the statement that the degree of protection, as indicated by the death-rate, is found to bear a very close and direct relation to the character of the vaccine-cicatrices. Welch says that one good scar indicates complete insusceptibility to small-pox, and it would be impossible for multiple scars to do more.

All statistics prove one point—that is, that, although vaccination does not confer absolute protection against small-pox, revaccination does so as nearly as possible. Thus, in the London Small-pox Hospital, among 734 attendants only 10 acquired small-pox, and these had not been revaccinated; the others had been revaccinated or had already had small-pox.

In the Municipal Hospital of Philadelphia, during a period of twenty-three years in which 5000 cases of small-pox were treated, no laundress, cook, resident physician, nurse, or any employé who was properly revaccinated upon entering on duty has been attacked by small-pox.

In connection with this subject it should be said that the statistics of Welch show that persons with poor marks as the result of vaccination in Germany have greater protection than those vaccinated in other countries. Although the Germans have multiple marks—sometimes as many as twenty—Welch thinks the superior protection due to the method (arm-to-arm on the eighth day) and the quality of the lymph used. I think it may fairly be questioned whether the statement in regard to method is true of all the cases. It will be interesting to see whether Germans inoculated in recent years with bovine virus are less protected. The subject seems an important one, and one that our immigration renders comparatively easy to elucidate.

The following figures from Guinon[1] also show the results of vaccination. In Sweden, before the introduction of vaccination, the death-rate from small-pox per 100,000 was 165.82. With voluntary vaccination it fell to 55.60; with obligatory vaccination and voluntary revaccination, to 18.20. In Germany the rate fell from 33.84 to 2.23, taking the results for ten years before and after vaccination became obligatory. In the army the death-rate fell to zero.

In the State of Michigan, before the organization of the State Board of Health in 1873, the death-rate from small-pox was 8.5 per 100,000, and from that time to 1890, 1.6 per 100,000. During the latter period a process of education was carried on in connection with the subject, and revaccination was common, though not obligatory. These statistics could be multiplied, but it is thought unnecessary to do more than give a few instances.

Vaccination can be practised at any age, and in times of epidemic it should be performed in the earliest days of infancy. Primary vaccination is usually performed at the age of from three to four months. According to Baginsky, erysipelas and purulent infections are commoner then than at a later age, but the general symptoms are less marked, and with improvement in technic the complications mentioned will be much less common.

Vaccination may be performed at any season. As a matter of comfort, it

[1] *Traité de Médecine*, tome ii.

is usually better to choose cool weather when there is no special danger. Acute infectious diseases do not contraindicate vaccination during the prevalence of small-pox.

It is usually assumed that vaccination will protect against small-pox after exposure only if performed at once; but there are numerous instances that go to prove that this assumption is not absolutely correct, and if for any reason vaccination has not been performed immediately after exposure, it should still be done as early as possible, in the hope that it may not be too late. Welch[1] has seen as many as twenty-eight children perfectly protected by vaccination during the stage of incubation. According to this authority, if performed within two or three days after infection, the protection may be complete, but if the operation be done less than seven days before the prodromal stage, there will be no modifying influence.

[1] *Loc. cit.*

# ENTERIC OR TYPHOID FEVER.

By J. C. WILSON.

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Studies in the natural history of disease and the science of bacteriology have put an end to blind confidence in drugs in the treatment of the infectious febrile diseases. A period, like the present, of rapid growth of knowledge concerning the etiology and pathology of this group of maladies, and of untiring research and experimentation to extend the borders of that knowledge, is hostile to traditional beliefs in the powers of medicines, and intolerant of their indiscriminate routine administration. This skepticism is the more wholesome because of the parallel though more halting progress in practical and experimental therapeutics, by which the direction and limitations of mere drug-effects have been approximately made known. Each of the infectious febrile diseases is a symptom-complex due to the access to the affected organism of pathogenic germs, which in their growth elaborate toxic principles that more or less rapidly and profoundly affect nutrition and excite reaction on the part of the nervous system. The sequence of morbid events and the termination of the process at a nearly definite period are due to special conditions of the germ-growth, among which is the production of other chemic substances inimical to the germ itself; complications and the fatal issue being attributable to inability on the part of certain organs, or the organism as a whole, to withstand the ravages of the process or to repel secondary infection.

The object of treatment must be either to place the patient under the most favorable circumstances and let the process run its course; or to come to the rescue when there seems to be especial need or danger; or to inhibit the growth or diminish the pathogenic energy of the infecting germ; or to increase the powers of resistance of the infected organism; or, finally, to anticipate the development of antitoxic principles by their artificial introduction into the body, and so to bring the morbid process to a speedy and fortunate issue. Science, a mistress without emotion, will not be satisfied with empiric methods. She demands that the physician, whatever his therapeutic procedure, whatever his appliances, shall have in view a definite purpose. Above all, she insists that he shall be on his guard against the spread of the infection. Placing the last first, because it is of first importance, the various methods of treatment may be arranged for purposes of discussion in the following order: Prophylaxis; the expectant method; the expectant-symptomatic; the specific or causal; the method of hydrotherapy; and, finally, prophylactic and curative inoculations.

There are two tests of the efficiency of treatment in serious acute diseases: first, the effect upon individual symptoms and upon the clinical course of the cases taken together in series; and, second, the influence upon the death-rate. The first of these tests, being largely affected by the personal equation of the observer, is unreliable; the second is satisfactory, but, owing to the wide variation in the clinical manifestations of all acute diseases, and especially of the group under consideration, requires for its successful application large collections of cases.

Ephraim of Breslau, in a recent communication on "The Significance of the Statistical Method in Medicine," says: "The statistics of the cold-water treatment of enteric fever are untrustworthy, because this disease shows the widest variations in its prognosis, and because, for this reason, an enormous number of observations are necessary to establish the value of a method of treatment." This statement is equally true of other methods. The relative value of different plans can be finally determined only by a comparison of the results of very large collections of cases rigorously submitted to the same management under similar conditions. This has been practically accomplished in the case of enteric fever. Satisfactory mortality-statistics can be obtained only from the records of large hospitals. The cases received into such institutions during a series of years enter under the same general conditions, allowance being made for the variation in the time that has elapsed from the beginning of the attack, and for difference in the gravity of the disease in different years. After admission the general management is practically the same, the profession being of accord as to details of nursing, hygiene, and diet. The methods of treatment, however, differ radically; but as perturbating drugs are not often employed, and those demonstrably capable of decidedly influencing the course and result of the disease in a favorable manner are not known, we are justified in arranging the present methods of treatment under two heads: first, the expectant or expectant-symptomatic plan; and second, the treatment by systematic cold bathing according to the method of Brand. The so-called antiseptic or causal plans of treatment are not now extensively employed. The fact that attention to detail on the part of the physician and the nurse, the judicious treatment of symptoms, and the careful management of the convalescence must exert a more favorable influence than the neglect of these measures is not overlooked, but the force of favorable measures of this kind is not likely to be wholly restricted to one or the other of two general plans.

An analysis of the hospital statistics of the period immediately preceding the introduction of the treatment by systematic cold bathing, and of the present statistics of hospitals in which this plan is not employed, shows a mortality ranging between 15 and 25 per cent., with occasional series of cases yielding a death-rate as low as 12 per cent. or as high as 30 per cent. The more recent statistics of those institutions in which cases of enteric fever have been treated exclusively by the method of Brand show an abrupt and sustained decline of the death-rate to about 7 per cent.

This estimate of the value of the treatment by systematic cold bathing now

rests upon statistics that fulfil the second requirement of Ephraim's criticism. The number of reported cases is enormous. They embody the results of observations by different clinicians in all parts of the world, and many of the collections of cases, as those of Brand himself, those of the military physicians at Lyons, those of Hare of Australia, and those of the German Hospital in Philadelphia, are sufficiently large in themselves to establish the value of the method. In point of fact, the literature of internal medicine shows no aggregate of statistics in regard to the treatment of any other disease that has reached such proportions and in which a definite plan has been carried out with the same rigid adherence to rule.

*Mountain-fever* is a term loosely applied to several different affections occurring at high altitudes. Among these is enteric fever. It is probable that a large proportion of the cases of fever occurring upon the great plateau of this continent and described as mountain-fever are in reality enteric. Hoff in 1880 reported a small series of cases in one of which post-mortem examination showed the lesions of the latter disease.

**Prophylaxis.**—The micro-organism described by Eberth, Koch, and Gaffky, and known as the bacillus typhosus or bacillus typhi abdominalis, is at the present time generally accepted as the cause of enteric fever. It completely fulfils two of the requirements of the law formulated by Koch in regard to the evidence that a disease is caused by a specific micro-organism—namely, (1) the presence of the organism in every case of the disease, and in such distribution as will explain the lesions; and (2) the isolation of the organism in pure culture. The third requirement of Koch's chain of evidence, that the disease must be reproduced by inoculation of the isolated organisms, has not yet been met. The conditions experimentally produced in animals by the inoculation of cultures of the bacillus typhosus have differed from the disease in man so widely in symptoms, course, and lesions that it has been impossible to regard them as demonstrably the same affection. The results have in most instances been due to the toxic rather than the infective properties of the inoculated substances. It has therefore been concluded that the lower animals are not susceptible to enteric fever. Quite recently, however, Cygnæus has produced, by the inoculation of Eberth's bacilli in dogs, rabbits, and mice, lesions of the small intestines analogous, both to the naked eye and upon histologic examination, to those found in man. Abbott in a number of similar experiments upon rabbits obtained a single positive result. In this case there was an ulcer in the ileum identical with those found in the small intestines in the human subject, and typhoid-bacilli were demonstrated in characteristic clumps in sections of the spleen, and were obtained from that organ by culture-methods.

The investigations of Sanarelli and those of Alessi indicate that the immunity of the lower animals may be artificially impaired. The former found that rabbits, guinea-pigs, and mice were rendered susceptible to infection with the typhoid-bacillus by previous injections of the products of the growth of certain saprophytes; the latter, that prolonged exposure to an

atmosphere charged with the exhalations from the contents of a cesspool or from other decomposing animal substances rendered rats, guinea-pigs, and rabbits susceptible to inoculations of cultures of typhoid-bacilli, fatal results following in the course of from twelve to thirty-six hours, lesions identical with those of natural enteric fever being found, and the presence of typhoid-bacilli being demonstrated in the blood, liver, and spleen. Silvestrini had previously shown that the blood of rabbits exerts a germicidal action upon typhoid-bacilli, but that by subjecting cultures of the bacilli that survive to the action of fresh defibrinated blood by a method of successive selection a culture resistant to the action of the blood of the rabbit was obtained. Rabbits inoculated with this culture developed symptoms of enteric fever, and showed after death intestinal hyperemia, swelling, and necrosis of Peyer's patches, and enlargement of the mesenteric glands and of the spleen. Successful cultures of the bacilli were made from the pulp of the spleen. Important as these results are, they cannot be regarded as final.

The wide variations in the morphology of the typhoid-bacillus in pure culture, and its resemblance to other organisms found in the intestinal contents of man and certain domestic animals, and in water polluted by their fecal discharges, notably the bacterium coli commune, increase the difficulties in the way of an absolute demonstration of the causal relation of this bacillus to enteric fever. Vaughan has gone so far as to affirm, as the result of a series of carefully conducted investigations, that enteric fever may arise in consequence of infection by any one or more of a number of closely related micro-organisms. These difficulties are, however, far from insurmountable, and the trend of scientific inquiry, especially of those investigations that have resulted in the discovery of specific toxic and immunizing substances produced by the bacillus of Eberth, converges toward the view, already almost universally accepted, that this organism is the specific cause of enteric fever.

So far as is known, the most active existence of this organism is parasitic. It grows, however, upon dead organic matter, and is therefore a facultative saprophyte. It is capable of prolonged existence under favorable circumstances, both within the body of a patient who has suffered from enteric fever, and outside of the human organism. Under this last condition it retains its vitality for a period of time that varies according to a number of circumstances. How long this period may be is not known. In ordinary water it is measured by weeks. Hochstetter found typhoid-bacilli capable of growing after they had been for twelve days in a siphon of seltzer-water. They survive longer in closed cisterns and reservoirs than when exposed to light; and it has been demonstrated by Janowsky that cultures cease to develop after some hours' exposure to sunlight. That they retain their power of growth in running water has been shown by the history of many epidemics. Prudden found them capable of culture after having been frozen in ice for several months, and after repeated alternate freezing and thawing. Prudden and Ernst found them in the water-filters of houses in which cases of enteric fever had developed. Whether or not they increase in ordinary water remains unsettled; it

is generally believed that some increase may take place. They grow luxuriantly in milk, without causing coagulation or changing its appearance in any respect. They continue to live for months in fecal matter, and many local outbreaks have been ascribed, with reason, to the disturbance of privy-vaults into which the stools of enteric-fever patients had been emptied several months or even a year previously. Uffelmann has shown that typhoid-bacilli have a remarkable tenacity of vitality in dried fecal matter. They not only continue to live, but also grow and multiply upon the surface of the soil, and, if the ground is frequently moistened, they penetrate to a considerable depth and preserve their activity for several months. Karlinski's experiments lead him to ascribe to typhoid-bacilli an inferior tenacity of life. He found that they ceased to live in the stools after the lapse of three months, and that the presence of liquefying bacteria has a very destructive effect upon them and causes them to disappear rapidly. The want of accord in the results of researches conducted by different observers is doubtless due to variations in the conditions of the experiment not always recognizable. There is no reason to suppose that typhoid-bacilli are capable of an indefinite existence outside the body, much less of indefinitely prolonged independent and vigorous non-parasitic growth. On the contrary, it is probable that sunlight, dispersion, the action of putrefactive bacteria (Karlinski) and unsuitable or insufficient pabulum would ultimately lead to their extinction were it not for their constant renewal by the infection of fresh cases.

The germs find access to the body in drinking-water defiled with sewage, or in polluted milk; exceptionally they may be inhaled with particles of dust floating in the air; but even then they are probably entangled in the secretions of the mouth or pharynx, and swallowed. The possibility that they may be present upon the surface of raw vegetables or other articles of food that have been washed with water containing them is not to be overlooked. They find their way out of the body in the stools, to a small extent in the urine when it is albuminous, and, very rarely, in vomited or expectorated matters. They are not eliminated by the expired air or by the skin. Enteric fever is not contagious in the ordinary meaning of the term. It is communicable through the infecting principle contained in the feces, and probably in no other way. The transportation of bacilli through the intermediation of house-flies to milk and other articles of food may serve to explain certain cases of apparently direct infection. This infecting principle is invariably derived, either directly or indirectly, from a previous case.

The foregoing facts relating to the existence of the typhoid-bacillus outside the body fully account for the widespread endemic prevalence of enteric fever and for the occasional occurrence of local epidemics. The doctrine of Murchison and his followers that the specific cause of this disease may be generated *de novo* in decomposing sewage in which the excreta of enteric-fever patients is not present is no longer tenable. There is no proof whatever that, in the absence of the specific pathogenic germ referred to, enteric fever can be generated by the products of decay or decomposition, by sewer-exhalation, by tainted

food, or by the action of other bacteria. In this connection, however, the observations of Alessi, already referred to, are very suggestive. There is reason to believe that the susceptibility of human beings to typhoid-infection may be enhanced by habitual exposure to an atmosphere charged with the gaseous products of decomposing sewage.

Enteric fever is, in theory, a preventable disease. The objects of prophylaxis are twofold: First, to prevent any patient ill with the disease from becoming a source of further infection; and, second, to correct, wherever they exist, faulty sanitary arrangements, which lead to the pollution by fecal matter of water used for drinking and domestic purposes. The systematic and effectual pursuit of these objects in all quarters in which the disease prevails would at once be followed by a notable reduction in the morbidity. Remarkable results have been accomplished upon a very large scale in localities shortly to be referred to, in which rational preventive measures have been only partially carried into effect. Their general adoption and rigid execution would, it is safe to predict, be followed by results no less beneficent to mankind than have been the disappearance of the plague from Western Europe and the deposition of small-pox from the rank of a perennial scourge of the human race to that of an occasional epidemic and wholly manageable disease.

The first of the two objects of prophylaxis—namely, the prevention of the spread of the disease from the patient as a focus of infection—falls within the line of duty of every physician. In enteric fever we have to do with a disease in which this is wholly possible. Not only can the diffusion of the typhoid-bacilli be prevented, but they can be at once and absolutely destroyed upon the spot. The patient thus ceases to be a source of infection both to those in his immediate vicinity and, what is often a more important matter, to those at a distance. For it is not alone the few that are near at hand who are to be protected, but also the unsuspecting many to whom the disease may be conveyed in consequence of the pollution of running streams or other sources of water-supply, or in cities by way of continuous sewer-systems transmitting the poison to remote localities.

The fecal discharges of every case and the urine when it is albuminous must be at once thoroughly disinfected. It is not enough that a small quantity of some disinfectant solution, however active, be poured over the stool in the vessel, shaken about and then emptied. When the bed-pan is to be used it must contain a half-pint (250.) of the solution employed; immediately afterward a pint (500.) or as much as a quart (1000.) of the solution, according to the amount of the dejection, must be poured over it, all thoroughly mixed by agitating the vessel and solid masses broken up with a stick, which must be forthwith burned. The vessel must then stand two or three hours before it is emptied into the water-closet or privy-vault. Prolonged exposure is necessary to complete disinfection.

A solution of chlorinated lime of the best quality, containing at least 25 per cent. of available chlorin, of the strength of 6 ounces (180.) to the gallon (4 liters) may be thus employed.

Equal parts of commercial sulphuric or hydrochloric acid and water will disinfect a stool in two hours. A solution of mercuric chlorid 1 : 500, acidulated with tartaric or hydrochloric acid, will disinfect an enteric-fever stool in six hours. The 5 per cent. solution of carbolic acid commonly employed is less efficient and requires twenty-four hours. A very efficient and rapid disinfectant for typhoid-stools is milk of lime, prepared by slaking freshly burned quicklime and stirring up the powder with twice its volume of water. This should be freshly prepared and added to the typhoid-stool in equal bulk.

Clear solutions, as of mercuric chlorid, should be colored by the addition of potassium permanganate, and all disinfectants must be kept in a place by themselves and conspicuously labelled "Poison."

Commercial preparations sold under various names for household and sick-room disinfection, being of unknown and doubtless inconstant composition and unduly expensive, are not to be prescribed.

The water-closet is to be flushed several times a day, to diminish the action of acid disinfectants upon fittings and soil-pipes.

Thoroughly disinfected stools may, in country places, be emptied into ordinary privy-vaults without risk; or, mixed with fresh earth, they may be buried in a trench, at a distance from all sources of water-supply. The important point is that they be thoroughly disinfected. In some country districts typhoid-stools are disposed of by mixing them with sawdust and then burning them—a method that has much to commend it.

A privy-vault requiring disinfection may be treated by slowly pouring into it a solution of a pound or two (0.5–1 kg.) of mercuric chlorid in several gallons of water, or by sprinkling the surface of the contents of the vault with chlorinated lime or freely with quicklime from day to day.

There is danger of spreading the infection through the accidental soiling of the patient's clothing or the bed-clothing with the fecal discharges. It is therefore important that the mattress of an enteric-fever patient should be protected by a rubber cover; and that articles of bedding and the patient's garments should be immediately changed when soiled. Should fecal discharges have become dried upon any of these articles, shaking should be avoided, and the stain should be moistened with a disinfectant solution prior to changing. A tub should be provided into which the garments of the patient, bed-linen, rubber sheets, and towels should be placed as soon as removed. They should be immediately moistened with a 5 per cent. solution of carbolic acid and removed as soon as possible to the laundry, where they should, without handling, be placed in the boiler and boiled for half an hour. They should then be washed with soft soap and thoroughly rinsed. Before using again they should be aired and, if practicable, exposed to the sun for several hours. In case of death the corpse must be enveloped in a sheet wet with carbolic-acid solution, 1 : 20.

On the recovery of the patient and his transference from the ward of the hospital or the sick-room, the rubber coverings used upon the bed are to be thoroughly disinfected, the bedstead and furniture washed with a solution of

mercuric chlorid 1 : 1000, all bedding, towels, etc. thoroughly boiled, and the room in a private house aired daily for a fortnight before it is again occupied.

During the prevalence of an epidemic all drinking-water and milk used in families should be subjected to boiling for thirty minutes. It is especially important that newcomers and temporary sojourners in a district in which enteric fever prevails should drink only boiled water and milk, and should avoid the use of uncooked vegetables.

In all instances search should be made for the source of the infection. In sporadic cases occurring in large cities such investigations are not often attended with success, except in detecting general defects in the water-supply or the sewerage. When, however, enteric fever breaks out as a local epidemic restricted to a district supplied with water from a particular source, or in a neighborhood supplied with milk from the same dairy, the results are often in the highest degree significant. They reveal grave defects in the supply of water or milk, as the case may be, the circumstances under which pollution has taken place, and indicate with precision the measures by which further trouble is to be averted. Especially are the results instructive in small towns or country places into which the bacilli are imported by the advent of cases of enteric fever.

Many local epidemics have been shown to originate in the contamination of the water-supply by a single patient. Among these, none perhaps, is more important and instructive than the well-known epidemic at Plymouth, Pa., in 1865, investigated by Shakespeare. A portion of the water of the town was derived from a reservoir supplied by a mountain-stream some distance above. A man ill with enteric fever occupied a house near the bank of this stream during January, February, and March. Upon the ground, frozen and covered with snow, the copious dejections of this patient were thrown without disinfection. Toward the end of March a thaw, accompanied by a rainfall, took place. About the 10th of April an extraordinary outbreak of enteric fever developed in the town, chiefly among those receiving water from the reservoir. In a population of 8000 people about 1200 cases occurred.

Arloing and Morat found typhoid-bacilli in four of six specimens of drinking-water taken from the source of supply at a school at Cluny during a local epidemic of enteric fever comprising 119 cases with 12 deaths in a general household of 235 persons. Typhoid-bacilli were discovered by Rodet in the water-supply of Ville-sous-Charmoux in a limited outbreak of enteric fever that occurred in the spring of 1887.

During the preparation of this article I saw, in consultation with Dr. Parker, a physician suffering from enteric fever whose illness arose under the following circumstances : The patient's house stands upon a small lot in a village, at that time free from enteric fever. The privy is an ordinary open concern upon the surface of the ground, such as is common in country places. The well from which the drinking-water is supplied is about twenty-five paces distant. Early in September the patient's brother came to the latter's house, ill with enteric fever. The discharges, treated with a small amount of a com-

mercial so-called disinfectant, were thrown into the privy. Toward the close of September the physician fell ill with enteric fever and within a few days three other cases occurred in his household.

The part played by milk in the transmission of typhoid fever was definitely established in 1871 by the investigations of Ballard into a local epidemic at Islington. This outbreak was due to the use of water defiled by direct communication with drains and by the backing up of the contents of the drains into the tank from which water used for washing the milk-cans was derived. Since that date a large number of local epidemics have been traced to infection by milk. In such cases the infection is not due to disease in the cows, but to an admixture of defiled water with the milk, either intentionally or as the result of the use of such water for the purpose of cleansing milk-cans.

In many local epidemics the most careful efforts to trace the source of the disease have been unsuccessful. In an epidemic that occurred a few years ago in a military academy in the neighborhood of Philadelphia this was the case. Fourteen cases of enteric fever developed in a very brief period among one hundred and thirty-two students. The disease was of virulent character, five of the fourteen cases terminating fatally. One of the patients, who was subsequently transferred to the German Hospital in Philadelphia, I first saw in consultation with the physician in charge. The most careful investigation revealed no source of infection. A possible explanation that the boys who were taken ill had been infected by drinking milk at a shop in a neighboring city could not be established.

Sporadic cases of enteric fever have occurred under circumstances that have baffled explanation, and particularly among small bodies of troops in regions almost without inhabitants, as in border campaigns. It has been suggested that in these cases the infection has taken place by means of typhoid-bacilli in condensed milk or other articles of food, and that the immunity of the majority of the company that escaped is to be ascribed to previous attacks of enteric fever. The alternate suggestion that the bacillus typhosus is a germ widely diffused in nature, and that it acquires pathogenic properties when developed in contact with decomposing fecal or other organic matter, is not generally accepted.

The second object of prophylaxis—namely, the correction, wherever they exist, of faulty sanitary arrangements that lead to the pollution by fecal matter of water used for drinking and domestic purposes, falls within the scope of municipal and other local governmental organizations. Want of power on the part of State Boards of Health, official ignorance and the apathy of the people conspire to render hope of the attainment of this object, even in enlightened communities, decidedly remote. Yet, viewed from the lowest standpoint, merely as a matter of economics, no outlay could prove more profitable for the tax-payer. Enteric fever especially selects for its victims adolescents and young adults; it is a long sickness with a protracted convalescence. In a not inconsiderable proportion of the cases it proves the starting-point of chronic disease. The exact annual cost of a polluted water-supply and bad drainage

and the resulting endemic prevalence of disease is not easy to compute, but the money-value of the lost time, together with the expense of support, nursing, and incidentals, makes, in a large city, an enormous aggregate—more than sufficient to correct the unsanitary conditions to which the fever is directly due.

In cities an abundant and good water-supply is of first importance. The natural history of the water is better evidence of its purity than the results of chemic and biologic tests of occasional samples. The ideal supply is that derived from mountain-lakes or streams in districts free from population, or from artesian wells. It is practically impossible to protect streams that flow through populous valleys, or to prevent ordinary wells from becoming contaminated by soakage. The abandonment of wells constitutes, therefore, an essential measure of prophylaxis against enteric fever in cities and towns, while those communities whose water-supply is derived from water-courses that receive the sewage of other towns and villages can only hope to escape the endemic, and occasional epidemic, prevalence of the disease by filtration upon a large scale, and in accordance with scientific methods, before distribution.

Mosny showed that the death-rate from enteric fever in Vienna diminished from 12.5 per 10,000 to 1.1 per 10,000 after the introduction of water from the neighboring mountains. When, however, a few years later, owing to some defects in the water-works, it became necessary to again use the water of the Danube for a short period, a serious epidemic broke out that was confined to those parts of the city in which this water was distributed. Similar local outbreaks have followed the employment of the water of the Seine for drinking-purposes in Paris.

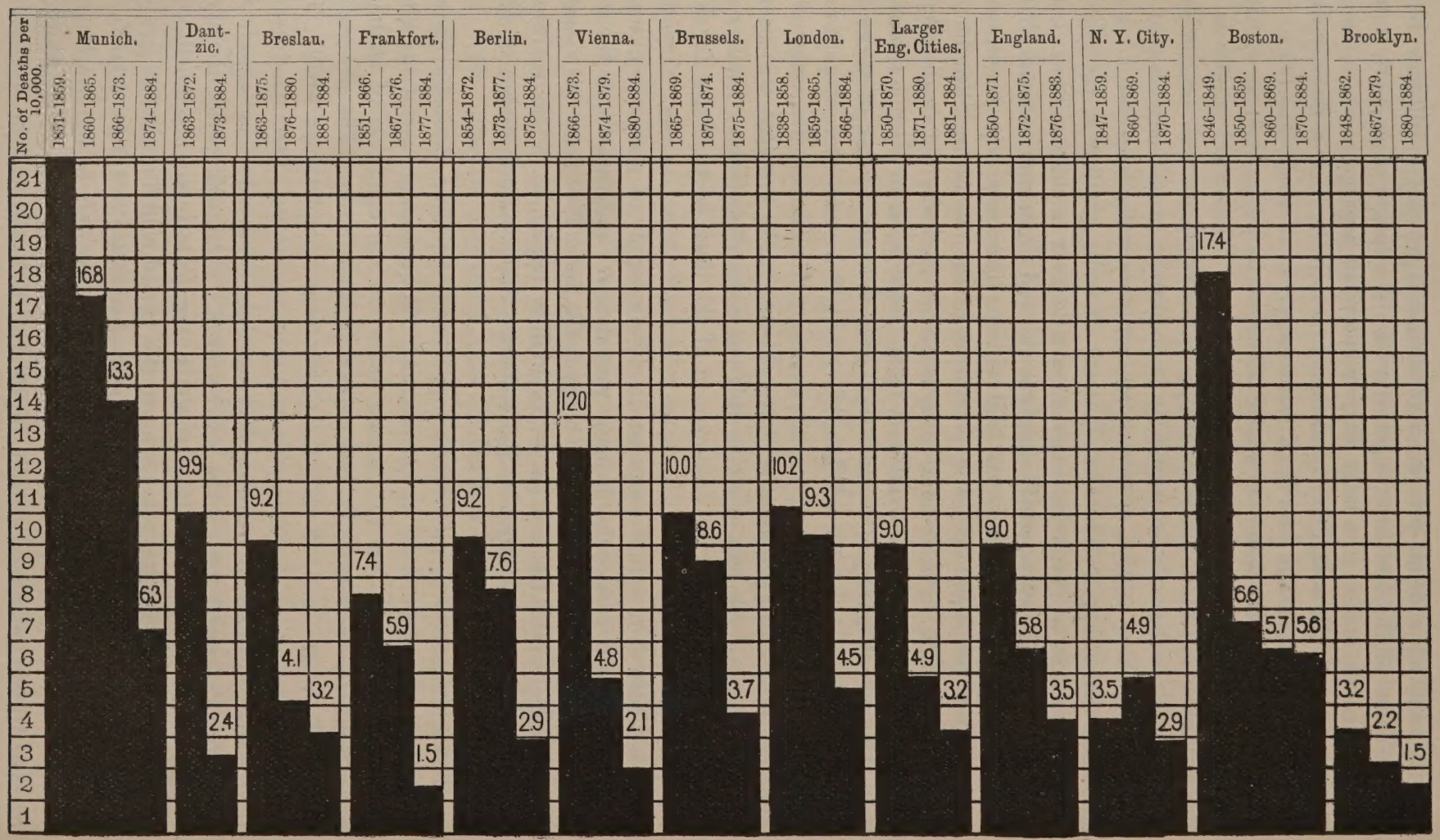
It has been shown, however, that in cities a supply of good water is not in itself sufficient to reduce the endemic prevalence of enteric fever to the lowest point. There is a correspondence between the morbidity from this cause and the drainage, which has not as yet been fully explained. This correspondence has been demonstrated by the elaborate and accurate studies of Erwin F. Smith in 1885.[1]

The influence of a pure water-supply and improved drainage upon the prevalence of enteric fever is conspicuously shown in the case of the city of Dantzic. The death-rate in Dantzic under the old condition of affairs was never much lower than 10 in each 10,000 persons living. The city was supplied with water in 1869 and the sewers were completed in 1872. These public works were executed rapidly and were complete. The introduction of pure water produced no marked effect upon the death-rate from enteric fever until after the completion of the sewer-system. From this period the average of the twelve years was 2.4 per 10,000 living, or less than one-fourth of the mean mortality of the ten years prior to this period, while in the last five years of the period ending in 1884 the death-rate had fallen to 1.5 per 10,000.

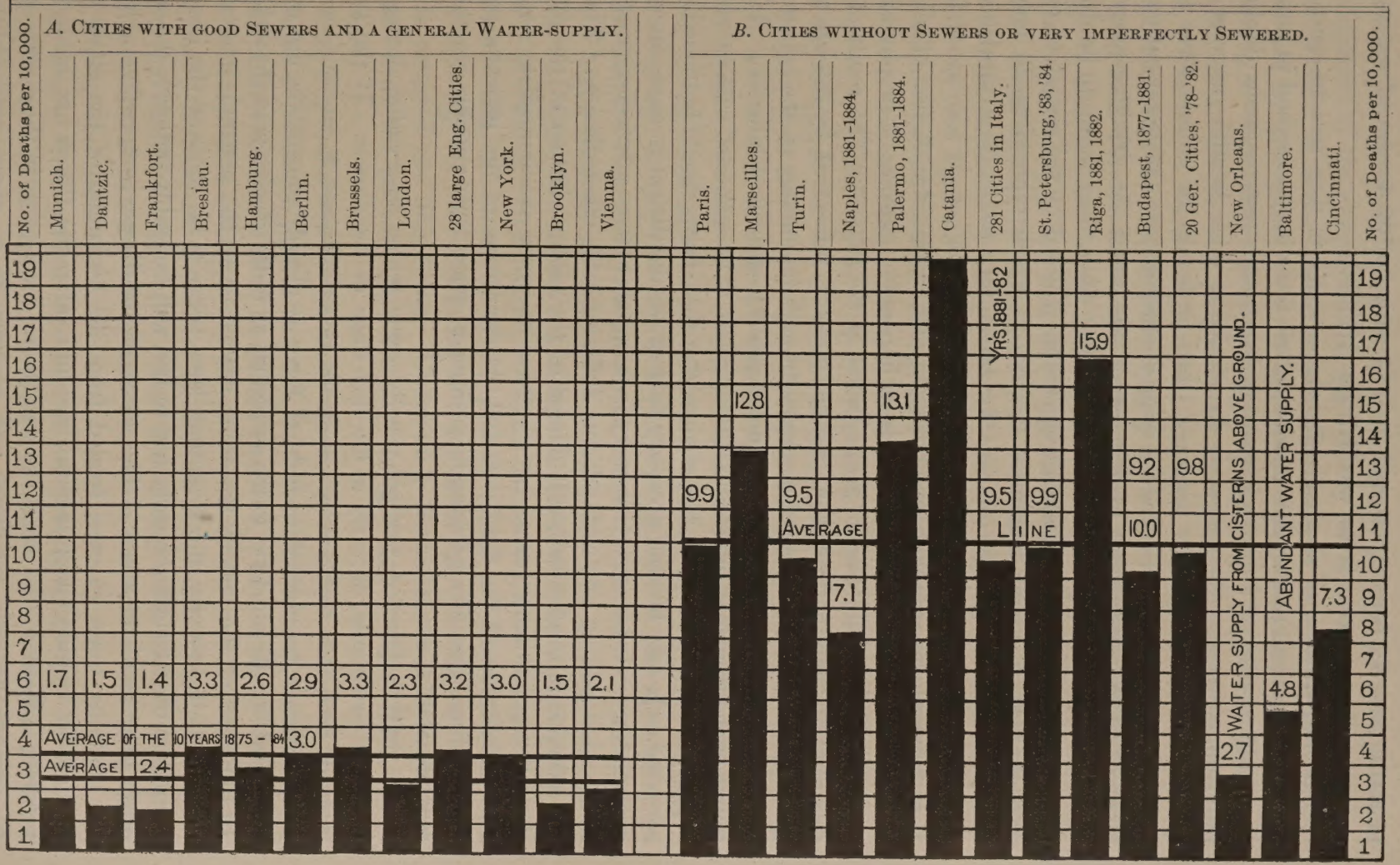
In Stockholm the mortality decreased progressively as the sewer-system was extended. Thus in 1877, with 8937 meters of sewers, the mortality was 5.1 per 10,000 inhabitants, while in 1883 with 40,435 meters of sewers the

[1] *Proceedings and Addresses at the Sanitary Convention at Ypsilanti, Mich.* Lansing, 1886.

DEATHS FROM ENTERIC FEVER TO EACH 10,000 INHABITANTS BEFORE, DURING, AND SINCE THE INTRODUCTION OF SEWERAGE AND WATER-SUPPLY.



DEATHS FROM ENTERIC FEVER TO EACH 10,000 INHABITANTS IN SEWERED AND UNSEWERED CITIES. AVERAGE OF FIVE YEARS, 1880–1884, UNLESS OTHERWISE STATED.



mortality was 3.7 per 10,000, and in 1887 with 65,709 meters of sewers the mortality from enteric fever was 1.7 per 10,000.[1]

The introduction of thorough drainage-systems is thus seen to constitute a means of general prophylaxis against enteric fever in cities second in importance only to that of a pure water-supply. As such sewer-systems discharge into running streams the danger is transferred to other localities more or less remote. It has frequently happened that outbreaks of enteric fever have occurred among the crews of ships lying at anchor near the sewer-outlets of large cities in consequence of the use of the water for drinking-purposes. Quite recently local epidemics of enteric fever have been shown to be due to the consumption of oysters taken from waters polluted by the sewage of cities. Definite facts as to the maximum distance to which typhoid-bacilli may be transported, and the length of time for which they retain their virulence in large bodies of water under these circumstances, have not yet been ascertained. It is, however, obvious that the immediate and efficient disinfection of all the stools in every case of enteric fever is an imperative measure of prophylaxis.

**Treatment.**—*The General Management of the Patient.*—The result of the treatment in enteric fever is in a large measure influenced by the attention given to the details of general management and the nursing of the patient.

It is important to see that he is not exposed to continued infection. If the source of the trouble is found upon investigation to be connected with the water-supply, or the milk-supply, it is obvious that these faults should be immediately corrected. It may become necessary to remove the patient to more favorable surroundings. It has been customary in hospitals to treat enteric-fever patients in the ward side by side with patients suffering with other diseases. Though this practice is unattended with danger of the communication of the disease if proper precautionary measures are taken to secure the immediate removal and disinfection of the dejections and the cleanliness of the patient's person and bedding, there is a growing disposition to place fever-patients together in separate wards.

In private practice patients usually come under observation during the period of prodromès, or early in the first stage of the disease. If the symptoms are such as to excite even a suspicion that the disease is enteric fever, the patient should be ordered to bed; if fever is already present the use of the thermometer will add force to the suspicions as to the character of the sickness. In the event of the malady not being enteric fever, the patient's interests do not suffer; if, however, the symptoms later prove to be those of the developing period of enteric fever, early rest in bed will favorably influence the subsequent progress of the attack. The course of the disease is more favorable and the mortality lower in cases treated from the beginning of the attack than in those not coming under medical care until after the illness has made some progress. Many of the worst cases of enteric fever occur in those who struggle against the early symptoms and continue to go about until obliged to betake themselves to bed by the intensity of the febrile movement, the urgency

[1] Osler: *Johns Hopkins Hospital Reports*, vol. iv.

of diarrhea, or by sheer prostration. The fatigue of long journeys after the development of the symptoms, and particularly of railroad-travelling undertaken in order to reach home, has very frequently exerted an injurious influence upon the subsequent course of the attack. Absolute rest in bed from the beginning of the sickness is of primary importance. The patient should not be allowed to rise for any purpose until some days after complete defervescence. The use of the urinal and bed-pan must be enforced. Patients very often declare that it is impossible to empty the bowel in the recumbent posture, but upon trial they find this less difficult than anticipated. Strict rules in regard to absolute rest in bed and the use of the bed-pan and urinal cannot always be enforced in the case of young children.

The room should be large and well ventilated. Unnecessary hangings and furniture should be removed. Preferably the apartment should be warmed by an open fire-place rather than by furnace-heat. Thorough ventilation must be secured during both day and night; and, while direct drafts are to be avoided, it must be impressed upon the attendants that the fever-patient is, with ordinary care, little liable to "take cold." There are some advantages in the use of communicating-rooms, the doors between which may be kept open and from one to the other of which the bed of the patient may be occasionally transferred, the windows of the unoccupied room being thrown open. In cities it is often desirable that the patient should occupy a room remote from street-noises; in warm weather the bed may be removed with advantage during the day to a porch or gallery in the open air.

The fatigues of nursing are greatly lightened by the use of a single bed, not too high, such as an ordinary hospital-bed. The mattress should be smooth and firm, but elastic. A rubber cloth should be placed under the sheet. The bed-covering should be light, but varied from time to time in accordance with the sensations of the patient. In severe cases, attended with the involuntary evacuation of urine or feces, the soiled clothing is to be immediately removed and disinfected. Under these circumstances it is desirable to use two beds, the patient when necessary being rolled or lifted from one to the other.

Disturbing influences of all kinds are to be avoided. Mirrors, pictures, or articles of furniture that attract the patient's attention may become objects of annoyance and should then be quietly removed. The wants of the patient are to be attended to quietly, noiselessly, and without conversation or comment. In the early days of convalescence the visits of friends are to be restricted in number and should be very brief. Tact is necessary at this period in communicating details of business-affairs and matters of annoyance that have transpired during the sickness.

The enteric-fever patient who has shown the slightest signs of delirium must, under no circumstances, even though he at the moment appear perfectly rational, be left alone, until convalescence has been established. Suicidal impulses are not rare, and many patients have destroyed themselves during the brief absence of their attendants.

Too much stress cannot be laid upon the importance of good nursing. To the physician it means systematic and accurate reports at his visits, responsibility and vigilance in his absence; to the patient, quietude, gentleness, neatness, lessened discomfort; to both, the best use of the resources of medicine in diminishing suffering and preventing complications.

Fluids should be administered freely. It not infrequently happens that a patient, even when apparently fully conscious, fails to obtain the necessary amount of drink. It is important, therefore, that it be offered in small amounts at short intervals; though not asked for, it is usually taken with eagerness. Fever-patients can consume with advantage large amounts of fluid, and there is little risk that a judicious nurse, administering water in small quantities at a time, will give in the aggregate too much. Pure cold water is the best drink for fever-patients. Wine and water, jelly-water, or thin barley-water may be given occasionally instead of simple water. The aërated mineral waters sometimes afford an agreeable change. Iced tea or weak lemonade may also be given if desired.

*The Diet.*—The food throughout the attack should be nutritious, easy of digestion, and liquid. The physician must give definite and explicit directions as to its kind, quantity and intervals of administration. A record of the amounts given should be kept by the attendant and submitted at each visit. The importance of every detail of the diet and the gravity of the disease preclude alike general directions on the part of the physician and general reports on the part of the nurse. The patient should receive the maximum quantity of food that can be assimilated, and no more. The amount must be determined by the careful study of the individual case. Over-feeding is sure to cause indigestion and an aggravation of the symptoms of the intestinal catarrh, which is so important an element of the disease; while under-feeding increases the asthenia and prolongs convalescence. During the first ten days the quantity of food should be very moderate; after that period as much is to be given as can be properly digested. In some cases the repugnance to all suitable foods is so great that there is difficulty in administering enough; in the greater number, however, the mental condition is such that the patient takes without question whatever is proffered him in the way of food or medicine. On the whole, enteric-fever patients are usually rather over-fed than under-fed. The evidences of the former error are to be found in signs of gastric indigestion, increased diarrhea, and the presence of milk-curds in the stools.

Milk holds the first place among fever-foods. It supplies needed liquid; it is, as a rule, readily digestible; it is abundantly diuretic. It, therefore, usually constitutes the sole diet, or the basis of the diet. If used alone, the daily amount for an adult should not much exceed three pints (1500 c.cm.) during the first period of the disease (that is, until about the middle of the second week) or two quarts (2 liters) during the latter period. This quantity is to be given in divided portions at intervals during the twenty-four hours. Milk may be administered raw or boiled, warm, cold or iced, or it may occasionally be given coagulated into soft curds by means of rennet. Lime-water

should be added in the proportion of one part to four or five, or the milk may be diluted with one-third its volume of Vichy water, a mixture at once more digestible and more palatable to many patients than ordinary milk. The repugnance of some patients to a milk-diet may be overcome in part by the addition of coffee, or spirit, as brandy, whisky, or rum; the inability on the part of others to digest it, by partially peptonizing it, or by the fermentative processes through which it is converted into the koumiss, kefyr, or matzoon of the shops. In certain cases sterilized milk may be used for a time with advantage, but my experience is unfavorable to its continuous employment as a fever-food for adults. Buttermilk and wine-whey serve to vary an otherwise monotonous diet.

Once or twice a day a raw egg may be given beaten up in the milk, with or without spirit, or only the white of the egg mixed with an equal volume of water and flavored with a little brandy or sherry. In many cases, however, it is better to vary the diet; in some it is necessary to avoid milk altogether. Broths or soups prepared from beef, mutton, chicken, or veal, flavored with vegetable juices and containing a little rice or barley, but always carefully strained, may then be used. The dietary may also include *consommé*, either hot or frozen, according to the fancy of the patient, clam-juice, oyster-soup, thin barley-gruel, arrow-root, and the commercial malt-foods and peptonoids. The freshly expressed juice of partially broiled beefsteak may also be included. Coffee or cocoa, well diluted with milk, may be given once a day. Food should be administered every two hours during the day and at intervals of three or four hours at night. When the amount taken at a time is small or the prostration is extreme these intervals must be shortened. Under ordinary circumstances a restless patient who has just fallen into quiet sleep ought not to be disturbed for food. Patients who are very dull or stupid should, if possible, be fully roused before food is given, in order to ensure complete deglutition and thus diminish the danger of inhalation-pneumonia.

No solid food should be given until the evening temperature has been normal for at least a week. Even then the change must be tentative and gradual, by way of milk-toast, custards, light puddings and the like, to meats, vegetables, and ordinary articles of every-day diet.

The details of the diet in the case of young children must be determined in accordance with the age of the patient and the previous plan of feeding. In a majority of instances no radical departure from the usual nourishment is necessary, beyond the avoidance of every kind of solid or semi-solid food.

**Stimulants.**—The administration of alcoholic stimulants is a matter of the highest importance. It forms an essential part of the routine procedure in the treatment by systematic cold bathing and will be discussed in connection with that plan upon a subsequent page. In other plans of treatment the circumstances under which alcohol is to be used demand very careful consideration. Those who recall the methods of its employment some years ago are of accord in the opinion that it was very often given as a matter of course when not required and nearly always in amounts unnecessarily large. Even at the pres-

ent time it seems to me that alcohol is frequently used too freely in the sick-room. Certain it is that in mild cases of enteric fever in young persons of previously good health and habits little or no alcohol is required. The little that may be given with obvious advantage is needed at the close of defervescence, when there is often a subnormal temperature and much depression. It is certainly useless in such cases to administer alcohol in the early stage of the disease with the hope of preventing the occurrence of prostration and debility at a later period.

In persons of feeble constitution, in older persons, and in all severe cases, alcohol in some quantity must be systematically used. It must also be given from the onset of the attack to those who have previously been accustomed to its use, and to some extent in amounts proportionate to the habits of the patients. Even in cases in which it is clearly indicated alcohol should be given in restricted amounts during the early period of the attack prior to the subsidence of headache—an event that commonly occurs between the end of the first and the middle of the second week. After this time alcohol should be used more freely. As already pointed out, it may be added as a flavoring to articles of food, and it occasionally proves useful in stimulating the heart and to some extent as a food when there is great aversion to ordinary fever-foods.

Alcohol is further indicated in all cases in which there is great general prostration. It is especially indicated when there is weakness of the heart's action, as shown by a small, feeble, and irregular pulse, a weak cardiac impulse and faint first sound. It should be freely administered upon the development of marked delirium, tremor, subsultus tendinum, or other indications of profound derangement of the functions of the nervous system. The use of alcohol is especially important when symptoms such as frequent diarrhea, tympanites, and great tenderness indicate extensive and deep intestinal ulceration. In truth, the judicious and often generous administration of alcohol is imperatively demanded in all severe cases and upon the occurrence of serious complications, such as bronchitis of profound degree, broncho-pneumonia, croupous pneumonia, pleurisy, or peritonitis.

It is impossible to lay down any general rule as to the amount of alcohol to be administered in the individual case. This must be regulated according to its influence upon the symptoms for which it has been prescribed. The character of the first sound of the heart and of the pulse and the nervous symptoms forms the best guide as to the amount and frequency of administration. If the urine be albuminous, and in particular if it also contain casts, alcohol is to be given cautiously, and its effect upon the amount and character of the renal excretion must be carefully investigated from day to day. It is a good plan to begin with small amounts, which may be increased according to the requirements of individual cases. The best effects are in most instances produced by from 4 to 8 ounces (125.–250.) of spirit, or from a pint to a pint and a half (500.–750.) of sound claret, light Burgundy, or champagne in the course of twenty-four hours. Larger amounts may, however, be required in grave cases. Whisky or brandy may be given with milk in the form of punch, or,

if preferred, diluted with water. Wine-whey constitutes, in cases in which alcohol in small amounts is indicated, a very acceptable means for its administration.

In conclusion, alcoholic stimulants are to be given according to the special indications of each individual case. In a considerable proportion of the cases they are required in small amounts only; in some not at all. In the greater number of instances, especially in adults, they are useful, while in all cases of severe character they are imperatively demanded throughout the course of the attack and well into convalescence.

**Special Forms of Treatment.**—No drug or method of treatment is at present known by which enteric fever can be aborted. Many different methods of treatment have been advocated and innumerable drugs have been lauded as exercising a special favorable influence upon the course of the disease. Enteric fever, like the other acute specific febrile infections, runs a course uninfluenced by medicines. Blood-letting, emetics, purgatives, astringents, turpentine, silver nitrate, the mineral acids and antiseptics have been regarded in turn by earnest and conscientious practitioners as useful or necessary in the treatment of the disease. The greater number of these agents have no longer even an historic interest. They have been tested by their apparent effect upon individual symptoms and upon the clinical course of the cases taken together in limited series. This test, in a disease like enteric fever, which presents the widest variations in the intensity of the symptoms and in the course of individual attacks, is influenced by the personal equation of the observer to such an extent that its results cannot be accepted. In the words of Osler, "No known drug shortens by a day the course of the fever. No method of specific treatment or of antisepsis of the bowel has yet passed beyond the stage of primary laudation."

A consideration of the available data, including the present statistics of large general hospitals, warrants the assumption that at least 70 per cent. of the cases recover under indifferent methods of treatment; that about an additional 15 per cent. of the cases, or 85 per cent. of all patients, get well under various plans of management, which include strict attention to diet, good nursing, and the prompt and judicious treatment of urgent symptoms and complications; and that under treatment by systematic cold baths according to the method of Brand, the recoveries among cases coming under treatment early in the course of the disease are not less than 93 or 94 per cent. The death-rate as a test of the value of treatment, when made upon a sufficiently large scale, must be regarded as conclusive.

As the method of Brand—which shows a mortality of 7 or 8 per cent., according to the least favorable estimate, as compared with 12 or 15 per cent., as the most favorable estimate, of the expectant-symptomatic plan—is at the present time upon trial, so to speak, with the profession at large, and is only slowly forcing its way into general recognition, it cannot, despite its absolute value in saving life, be considered alone in an article like the present. We shall therefore discuss in turn (1) the expectant and expectant-symptomatic

plans; (2) the so-called specific or causal plan; (3) the method of hydrotherapy; and (4) prophylactic and curative inoculations.

1. *The Expectant and Expectant-symptomatic Plans.*—The milder cases do well without medication. Absolute rest in bed, skilled nursing and a carefully regulated dietary comprise all that is required in the proper management of the case. With moderate fever, a good heart, no signs of serious intestinal lesions, and the absence of pulmonary complications, the administration of drugs is needless. In cases of this kind there is frequently a tendency to constipation. The treatment, may, therefore, be advantageously commenced with laxative doses of castor-oil or of calomel, which should be repeated once or twice until the end of the first or the middle of the second week of the attack. Later than this, constipation is best relieved by enemata of lukewarm water to which has been added common salt in the proportion of a teaspoonful to the pint, or of soapsuds, or of thin gruel; or, these failing, glycerin with water, or glycerin-suppositories may be used with advantage. These measures, employed to secure the action of the lower bowel, do not require repetition more than once in three days. Cases treated with harmless fever-mixtures, or with small doses of quinin, the mineral acids, turpentine, silver nitrate, or other drugs that have no effect upon the course of the disease, but are, fortunately, usually well tolerated by the patient, must be regarded as managed in accordance with the expectant method.

The expectant-symptomatic or so-called rational plan is more extended in its scope. Its advocates seek by the administration, from the beginning, of one or more of the medicinal agents just named, to favorably modify the various symptoms of the disease and diminish the danger of complications. Whether or not these results are ever actually accomplished cannot be positively affirmed. The great variation in the intensity of the attack in different cases must put us on our guard against ascribing to therapeutic measures results that should properly be attributed to the course of the disease in particular cases. Under this plan of treatment efforts are made not only to prevent the development of serious symptoms and complications, but also to combat them as they appear. In this connection we may, therefore, with advantage discuss the management of the various symptoms and complications.

*Treatment of Special Symptoms and Complications.*—The early headache requires, as a rule, no special treatment; it subsides spontaneously between the end of the first and the middle of the second week. The quiet of the sick-room, the exclusion of light, applications to the head, cold or hot according to the sensations of the patient, are in many instances sufficient to control the headache. To some patients applications of cologne-water, of spirit of camphor, of menthol, or of chloroform are grateful. When headache is persistent or distressing the modern analgesics are indicated. Antipyrin, acetanilid, phenacetin cautiously given in small doses repeated at short intervals are efficacious. They should be discontinued upon the relief of the symptom. These drugs may with advantage be given in some cases in combination with caffein, sodium salicylate, or sodium bicarbonate.

Sleeplessness is sometimes a troublesome symptom in the early stages of enteric fever. Like the headache, it very often diminishes during the course of the second week. On the other hand, it is occasionally persistent and exhausting. The insomnia of the early course of the disease may be controlled by sodium bromid or by chloral. These drugs may be used either in combination or separately. Chloral alone in moderate doses, given at night, is usually followed by satisfactory sleep, and its administration has not in my experience produced cardiac depression or other unfavorable results. Sulfonal, trional, and chloralamid are less satisfactory hypnotics. Recourse to opium or its derivatives should be had only when other sleep-producing drugs are without effect. The preparations of opium must be regarded as objectionable in the early stage of the disease, on account of their unfavorable effects upon the digestion and the secretions, but more particularly on account of their liability to be followed by disagreeable after-effects, such as nausea, vertigo, and the intensification of headache—a liability not wholly obviated by the hypodermic use of morphin. Later in the course of the disease, that is during the period of the secondary fever, opium becomes at once the most efficient and the safest means of controlling prolonged sleeplessness and excitability. At this period its effect upon the secretions is less unfavorable than earlier in the course of the disease, while its disagreeable after-effects are, owing to the obtunded condition of the nervous system, reduced to a minimum.

Somnolence, stupor, and delirium are to be treated by stimulants and external antipyretics. As a stimulant, alcohol stands first and almost alone; spirit of chloroform and spirit of camphor are of use in emergencies; the latter may be administered hypodermically in 5 per cent. solution in ether, of which 10 minims (0.62) may be repeated once or twice at intervals of several hours, the toxic effects of large doses of camphor being carefully considered. The hypodermic administration of ether alone in 10-minim (0.62) doses is of advantage. Ammonium carbonate is of inferior value; on account of its expectorant properties it is, however, frequently used in the treatment of pulmonary complications. Pure Siberian musk has the reputation of being a powerful stimulant in conditions of nervous depression. It may be given in pill or suppository in single doses of from 5 to 10 grains (0.32–0.65) which frequently have an effect lasting for a considerable time. Its great cost and the difficulty of obtaining it, together with the uncertainty of its effects, stand in the way of its general use. Hyoscin hydrobromate in small doses hypodermically, codein, and suppositories containing asafetida are also useful in the treatment of active delirium, while in cases of hysteroidal delirium the bromids in elixir of ammonium valerianate are frequently followed by good effects. If delirium be marked or stupor tending to coma develop, benefit is frequently derived from the application of cold to the head, face, and chest by means of the cold douche or the use of an ice-cap, the hair having previously been cut short. These applications of cold must be transient and not too frequently repeated, lest they be followed by depression and collapse. When they are employed it is important to use at the same time warm applications to the feet and legs and

sinapisms to the precordium and epigastrium. The tepid or warm bath, or the warm bath of which the temperature is gradually lowered, is often followed by good results. I repeat that the enteric-fever patient should be closely watched. If delirium has shown itself, to leave him alone for an instant is to invite serious disaster. Many patients have availed themselves of the momentary absence of the attendant to destroy their lives. The delirium of enteric fever, even when active, is usually manageable. Good nursing is indispensable. Physical restraint is rarely necessary. Occasionally, especially in hospitals where the nurses have several cases to care for, it may be necessary to confine the patient by a sheet passed over the lower part of his chest and fastened beneath the bed.

Tremor is a sign of grave prostration. Sir William Jenner called attention to the fact that tremor out of proportion to the other signs of nervous prostration is usually a sign of deep ulceration of the intestine. A deep slough, which upon separating is liable to give rise to intestinal hemorrhage or perforation, may occasion marked tremor. This symptom is to be treated with alcohol freely and opium in full doses, both for their general effect upon the nervous system and for the local effects that are ascribed to them in limiting sloughing and ulceration.

Other nervous manifestations of enteric fever appearing during the course of the disease do not, as a rule, call for treatment. Those that persist after the subsidence of the febrile movement are to be treated in accordance with general rules.

The fact that the nervous phenomena directly due to the infection often closely simulate those of meningitis renders the recognition of actual meningeal inflammation, when it arises as a complication, a matter of difficulty. In this connection attention is called to the exceptional cases in which enteric fever at its onset closely simulates cerebro-spinal meningitis—the so-called cerebro-spinal variety of enteric fever. In this group of cases the attack begins suddenly with intense headache, nausea, sometimes vomiting, painful rigidity of the muscles of the back of the neck, contracted pupils, and constipation. The differential diagnosis between cerebro-spinal fever and enteric fever cannot at once be made. The appearance of the rose-spots and the enlarged spleen about the close of the first week demonstrate the true nature of the malady, which from this period usually runs its ordinary course. Actual meningitis, occurring as a complication, usually makes its appearance late in the course of the attack or during convalescence. As soon as recognized it demands energetic measures of treatment. Opium in full doses, the bromids, cold applications to the head, external warmth to the trunk and extremities, even the cautious abstraction of blood by leeches applied behind the ears, may be indicated.

Dryness of the tongue and the accumulation of sordes upon the teeth and gums demand the frequent administration of water in small amounts, or small pieces of ice allowed to melt in the mouth. The nurse should frequently wash the mouth with pure water, or water containing claret or small amounts of tincture of myrrh. The mouth may also be cleansed by the use of a mop

wet with a saturated solution of boric acid. Fissures at the nostrils or at the angle of the mouth or upon the lips may be lightly touched with a soft ointment containing 20 grains (1.3) of boric acid to the ounce (32.).

Vomiting is an unusual symptom in enteric fever. It sometimes occurs at the onset of the disease as one of the manifestations of profound infection, and is then accompanied by other evidences of grave toxemia, such as very high temperature, marked asthenia and copious diarrhea. It may also occur at the onset of the attack in consequence of gastric irritability. It is then an indication for the temporary withholding of food and the administration of fractional doses of calomel at short intervals—gr. $\frac{1}{12}$ (0.0054) every half-hour—or full doses of chemically pure cerium oxalate or of dilute hydrochloric acid. Small amounts of iced dry champagne are also useful, together with applications of a wet towel sprinkled with chloroform, or sinapisms to the epigastrium. Vomiting may be due to antecedent gastric catarrh or gastrectasis. When this symptom occurs later in the course of the disease it may be due to uremia, and is then associated with other evidences of nephritis. In all cases the urine should be systematically examined at intervals of two or three days from the beginning of the attack. A trace of albumin, with or without scanty hyaline casts —febrile albuminuria—is not significant; but pronounced albuminuria, with numerous casts, and especially epithelial or blood casts, indicates an intercurrent acute nephritis.

Constipation, which appears to be the rule rather than the exception in the enteric fever of the present time, requires, when slight, no treatment beyond the occasional administration of small doses of calomel or castor-oil prior to the tenth day of the attack. Slight constipation, in the absence of extensive intestinal lesions and of the intestinal catarrh with which such lesions are associated, results from the continued use of a diet that is at once concentrated and leaves a minimum of unabsorbed residuum. Constipation may, however, be due to torpidity of the large intestine, the fecal matter accumulating in the form of scybala and the stools being hard and dry. These conditions sometimes set up a sort of secondary diarrhea, due to irritation of the lower bowel, attended with a feeling of local distress and tenesmus, unusual in enteric fever and promptly relieved by the removal of the cause. Prolonged constipation is not in all cases the sign of moderate intestinal lesions; on the contrary, deep ulceration of a single Peyer's patch may arrest peristalsis and thus cause constipation. For this reason the administration of laxative drugs by the mouth after the middle of the second week is attended with the danger of inducing active intestinal movements which may result in the detachment of a deep slough, or in otherwise causing perforation when the slough extends to or implicates the serous coat of the intestine. Large enemata, especially if administered with some energy, are attended with a like danger, as they, too, may set up active peristaltic movements, which may extend to the lower part of the ileum. After the middle of the second week the constipation of enteric fever is best treated by the administration every day or every second day of small enemata of warm soapsuds or of thin gruel.

As long as the stools are of moderate amount and do not number more than three or four in the course of twenty-four hours, diarrhea requires no special treatment. When, however, the passages are copious or frequent, efforts should be made to control them. In many cases diarrhea arises in consequence of errors of diet, such as the use of improper food or excessive amounts of food, particularly milk and strong animal broths, or beef-tea. Under these circumstances the substitution of a more suitable dietary is followed by relief. In other cases diarrhea arises in consequence of the administration of excessive amounts of fluids, which pass through the bowel without being absorbed and excite the secretions of the intestinal mucous membrane. In the absence of these causes the diarrhea is symptomatic of the catarrhal enteritis that is a result of the general pathologic process. The preparations of bismuth, as the subcarbonate, subnitrate, salicylate, or subgallate, administered by the mouth in full doses and with a frequency dependent upon the urgency of the diarrhea, either alone or in combination with small doses of opium, Dover's powder or deodorized laudanum, constitute in most cases efficient medication; or, again, opium may be advantageously administered in enemata of starch-water or in suppository; or a combination of the aqueous extract of opium and the extract of cannabis indica in suppository may be employed. Such drugs as naphthalin, thymol, and resorcin, supposed to act directly as intestinal antiseptics, have in my experience proved far less useful, while such astringents as alum, plumbic acetate, silver nitrate, tannic acid, catechu, and kino have only an historic interest. If the stools be highly fetid or ammoniacal, half-dram (2.) doses of animal charcoal in the form of an impalpable powder may be administered in the broth. Creosote and carbolic acid may also be of service.

Tympanites is a common symptom. It may be caused by deep intestinal sloughing or ulceration, or by profound general asthenia, with deficient tonicity alike of the intestinal walls and of the abdominal muscles; or it may be due to the alteration in the character of the digestive fluids, which, no longer possessing the antiseptic properties of health, permit a speedy decomposition of the intestinal contents. In the majority of cases it is probable that these three causes act together. The flatus accumulates in part in the small intestine, but chiefly in the colon. It varies in amount from little in excess of the conditions of health to great abdominal distention, interfering with the movement of the diaphragm and, by its outward pressure upon the wall of the gut, increasing the danger of perforation. Excessive tympanites is an indication for the administration of alcoholic stimulants or for their increase if already employed. Turpentine or camphor, together with minute doses of opium, may be added to the treatment, and active preparations of pepsin or peptenzyme, alone or together with hydrochloric acid, should be administered with the food. Compresses wrung out of iced water, or turpentine-stupes, should be applied, and cautious, gentle massage of the abdomen is also useful. Small enemata of iced water and cold enemata containing turpentine are sometimes followed by good results. The careful introduction of a long rubber rectal tube will sometimes relieve the distention of the lower bowel. Puncture

of the distended gut with a hypodermic needle through the belly-wall is an unjustifiable procedure. Jacobi states that he has seen feces enter the abdominal cavity through openings thus made in cases terminating by fatal peritonitis.

Experience has shown that the systematic administration of laxative doses of calomel every second day during the first week tends to obviate to a great extent excessive intestinal disturbances, whether of the nature of constipation, diarrhea, or tympanites.

When slight, intestinal hemorrhage is to be treated by absolute rest, the temporary diminution or even the complete withdrawal of food for a time, and opium in moderate doses, either by the mouth or by suppository. Even water, for the time being, is to be administered only in small quantities repeated at short intervals; or small pieces of ice may be held in the mouth and permitted to melt. The action of the bowels is, so far as possible, to be controlled by the further administration of full doses of bismuth. If the loss of blood be large, danger to life becomes imminent, and more active measures are to be employed. An ice-bag or bladder filled with broken ice mixed with bran is to be applied to the abdomen in the region of the right iliac fossa. Opium is to be cautiously increased until its manifest effects—drowsiness and contraction of the pupils—are produced. Fluid extract of ergot may be administered by the mouth, but it is preferable to administer ergotin hypodermically at intervals of half an hour or an hour; if properly administered there is no danger of the production of abscesses. Small enemata of iced water, not exceeding four ounces at a time, may be administered and repeated at short intervals. There is no reason to hope that any direct effect upon the intestinal lesions will follow the use of the astringent preparations of iron, either by the mouth or by the rectum, or the employment of gallic acid, turpentine, alum, or lead acetate. The pillows should be removed and the foot of the bed elevated by blocks. If the loss of blood has been excessive a sterilized normal salt-solution may be introduced by hypodermoclysis, from four to six ounces (120.–180.) being administered at two or four different points. This method of restoring fluid to the body is altogether superior to intravenous injections. Transfusion of blood is attended with serious risk and is scarcely to be considered under these circumstances.

The occurrence of intestinal hemorrhage is usually attended with an abrupt and marked fall of the temperature and a notable improvement in the mental condition of the patient. These changes are usually transitory, though, exceptionally, they mark the beginning of convalescence. Such a fall of temperature, occurring in the mid-course of the disease, will arouse suspicion that hemorrhage has taken place, even though no blood may have yet shown itself in the stools. This suspicion will be confirmed by the discovery upon careful percussion of local dulness in a region of the abdomen previously tympanitic. For some time after a hemorrhage the diet should be restricted to a minimum quantity, and for a period of at least ten days no effort should be made to

move the bowels. Within this time, however, spontaneous evacuation very frequently takes place.

Peritonitis, whether due to perforation of the intestine or to other cause, calls for the free administration of opium. This drug should be given in the form of the deodorized tincture, in doses of 10 minims (0.62) at intervals of one or two hours, until evidences of its full physiologic effects are induced. If it be not well borne by the stomach, morphin is to be administered hypodermically. For a time at least no nourishment is to be given, except concentrated meat-juices, a spoonful at a time, and brandy and water may be given in the same amounts. The abdomen may be smeared with a mixture of equal parts of sweet-oil, lard, and turpentine, and covered with a large, thinly spread flaxseed-poultice; or ice-poultices may be applied. Should the patient's life be prolonged, it is of the utmost importance that the bowels be confined as long as it is possible to keep them so. As a general rule, an action will occur at the end of several days, even under the continued use of opium; if not, at the end of a week small, lukewarm enemata containing glycerin, or glycerin-suppositories, may be cautiously employed.

During the course of enteric fever palpation of the abdomen is to be practised with great caution, on account of the danger of exciting peritonitis, causing perforation, or rupturing the spleen. In a certain proportion of the cases peritonitis arises in consequence of infection through the base of an ulcer, without perforation. In other instances the sloughing out of the base of an ulcer that causes perforation is preceded by local adhesive peritonitis forming attachments with an adjacent viscus or coil of intestines. Under these circumstances general peritoneal infection does not necessarily take place and recovery may occur in exceptional cases. Under other circumstances, peritonitis due to perforation is almost invariably followed by death. Upon the occurrence of this accident at the close of defervescence or during convalescence, at a period when the appetite is returning, the nutrition improving and the strength of the patient augmenting, the propriety of celiotomy, with a view to the suture of the lesion, the resection of the bowel at the point of perforation, or the formation of an anastomosis between uninvolved portions of the intestine, and the proper treatment of the infected peritoneum, should be seriously considered. In selected cases surgical intervention finds its justification in the hopelessness of ordinary methods of treatment, and in the fact that a small proportion of favorable results have already been reported. Perforations are usually single; thus Murchison's cases showed only one perforation in twenty-eight, two in five, and three in four. In one hundred and sixty-seven cases of intestinal perforation collected by R. H. Fitz, one hundred and thirty-eight were single and twenty-nine multiple.

Collapse attending intestinal hemorrhage or perforation, or sudden failure of the heart, is to be treated by absolute quiet, lowering of the head, the application of external heat and the hypodermic injection of morphin, strychnin, ether, or solutions of camphor in ether.

Epistaxis is frequent in enteric fever. Early in the course of the disease it

is usually slight, often a mere stain upon the handkerchief, and only of diagnostic significance. Later, it is sometimes more abundant, but rarely dangerous. Local applications of ice to the nose and brow, an ice-bag to the nape of the neck, the slow instillation into the nostril of very hot water, and the introduction of slender cotton-tampons moistened and then rolled in antipyrin or wet with fluid extract of hamamelis are measures likely to control the bleeding. Should persistent hemorrhage from the nose occur, the anterior and posterior nares are to be plugged with strips of antiseptic gauze; or by Levis' method, which consists in the introduction of a small piece of disinfected sponge attached to a cord and pushed through the inferior nasal passage by means of a probe; other discs of disinfected sponge are strung upon the cord and pushed into the nose, while finally the anterior nasal opening is occluded by a similar fragment of sponge. The internal administration of ergot, turpentine, and preparations of iron is not usually followed by arrest of severe nasal hemorrhage. The oil of erigeron in large doses may be tried if other means fail.

Retention of urine occurs in a considerable proportion of the cases. It is well, therefore, to examine the suprapubic region by percussion as a matter of routine. Whenever necessary, the catheter is to be employed. A soft-rubber instrument is to be preferred in the case of the male, a glass catheter in the case of the female. These instruments should be thoroughly washed in recently boiled water both before and after use, and should meanwhile be kept in a solution of carbolic acid, one part to twenty-five; or of corrosive sublimate, one part to a thousand. They should be anointed with vaselin, which, if protected from the air, is usually entirely free from germs; and the parts about the meatus should, in each instance, before the introduction of the instrument, be bathed with acidulated sublimate-solution, 1 : 2000. These measures may prevent the otherwise not rare occurrence of urethritis, epididymitis, or cystitis—accidents that add unnecessarily to the suffering of the patient during convalescence, and in some cases constitute serious sequels.

Systematic exploration of the chest at short intervals by the methods of physical diagnosis is necessary. By this means grave complications, frequently attended with insignificant subjective symptoms, may be detected. In any case it is important to closely watch the condition of the heart and lungs.

Dicrotism, an indication of reduced arterial tension, diminishes, or in some cases ceases altogether, upon the administration of proper doses of alcohol. Cardiac asthenia, manifested by enfeebled impulse and faint systolic sound, also demands alcohol. It is also an indication for the employment of strychnin. When it becomes extreme, and heart-failure threatens, strychnin is to be administered hypodermically, the pillows are to be removed, the foot of the bed elevated by blocks, and absolute rest in the recumbent posture maintained. Sudden death has been recorded as a result of the patient's abruptly assuming the upright posture. In addition to strychnin in full doses, caffein citrate in doses of 2 grains (0.13) at intervals of one or two hours has proved useful in tiding over a period of marked cardiac failure. Digitalis in small doses is of questionable advantage; in larger doses it

is harmful in its effect upon the feeble heart of enteric fever. The nitrites, and especially amyl nitrite and nitroglycerin, on account of their rapid action, may be of service. The hypodermic administration of ether, or a 10 per cent. solution of camphor in ether, and sinapisms to the precordia and epigastrium, are also useful. The occasional application of turpentine-stupes to the chest is likewise of service.

Hypostatic congestion is to be prevented by guarding against the heart-failure to which it is principally due. The patient's position is to be changed from time to time from the dorsal to the lateral decubitus.

Bronchitis, if of moderate degree, requires no special treatment. If severe it must be managed in accordance with general principles. Dry cups may be applied to the chest, and inhalations of oxygen are especially useful when feebleness of the heart's action and respiratory failure show themselves in extreme pallor, cyanosis of the lips and finger-tips, mottling of the surface, coldness of the extremities, frequent or irregular pulse and enfeeblement of the first sound of the heart.

Inspiration through the glottis of the secretions of the mouth or of liquid food, in consequence of the condition of the nervous system, is a common cause of bronchitis and broncho-pneumonia. This may be obviated, in part at least, by thoroughly rousing the patient by the application of cold to the face, neck, and chest by means of a wet towel previous to the administration of nourishment.

Bed-sores are to be avoided by frequent change of position, by the removal of pressure by means of water-bags or air-cushions, by scrupulous cleanliness and by attention to the bed. If erosions by any chance appear they are to be treated upon general surgical principles. In protracted and severe cases a water-bed may become necessary. With proper nursing, bed-sores rarely occur.

The fever when moderate, the evening temperature not exceeding 104° F. (40° C.), requires no special treatment. This is particularly the case when the morning remissions are considerable, amounting to 1.5°–2° F. (0.8°–1.1° C.). When the temperature is higher than this, or when the morning remissions amount to a fraction of a degree only, antipyretic treatment becomes necessary. The view at one time generally entertained that the fever controls the situation is, however, not wholly correct. In a fever so prolonged as enteric fever a very high and unbroken temperature must be regarded as a grave symptom, and as unfavorably affecting the prognosis. Yet we frequently see cases terminate in recovery in which the febrile movement has reached or even exceeded 105° F. (40.6° C.) and, with very slight morning remissions, has remained high for many days in succession. On the other hand, a fatal termination may occur in cases in which the temperature at no time rises above 103° F. (39.4° C.). It is thus evident that the height of the fever is not an absolute gauge of the intensity of the infection, but rather a manifestation of the reaction to toxic principles on the part of the organism, which varies with different individuals. Among the drugs that possess the property of promptly

reducing febrile temperatures are certain of the modern antipyretic analgesics and especially antipyrin, acetanilid, and phenacetin. This property is possessed to a less extent by sodium salicylate and by quinin in massive doses. The rapid and extensive falls of temperature that follow the administration of full doses of such drugs are attended with excessive sweating, feeble action of the heart, a tendency to collapse and other evidences of profound perturbation of the already disordered functions of the nervous system. The reduction in temperature is transient in character and soon followed by a rise to the former level, while the effect upon the general course of the disease is, as a rule, far from favorable. For these reasons the administration of drugs for the purpose of reducing the temperature in enteric fever has been generally abandoned. Nor have more satisfactory results followed the attempt to reduce the temperature by the administration, at short intervals, of small doses of the drugs named. An equally profound impression upon the temperature may be secured by the application of guaiacol to extensive surfaces of the body, but the depression and sweating that attend the resulting fall of the temperature likewise preclude the routine use of this measure.

External antipyretic treatment consists in the systematic application of cold water or ice, and includes cold sponging, cold compresses, the application of ice, the cold pack, the cold or gradually cooled bath, cold affusion, iced-water enemata, and the use of Leiter's coils. The therapeutic action of external antipyretics, whether in the form of baths or of other cold-water applications, is greater in children than in adults, in proportion as the extent of surface to which the application is made is relatively greater as compared with the volume to be cooled. The effect is greater and more rapid, the disturbances of circulation are more decided, and the reaction is more tardy. The employment of cold in the treatment of enteric fever in childhood demands, therefore, some degree of caution.

*Cold Sponging.*—The water may be of the temperature of the room or cooled with ice. Alcohol, vinegar, or Labarraque's solution of chlorinated soda may be added. The bed must be protected by mackintosh or rubber sheeting. The sponge or wash-cloth should be used with moderate friction. Every portion of the body is in turn bared, washed, quickly dried, and again covered. Spongings may be repeated at intervals of two or three hours; when the temperature is very high, even every hour. In the hands of a skilful nurse cold sponging adds greatly to the comfort of the patient, and exerts a favorable influence upon the nervous system and upon the circulation of the blood. It reduces the temperature but slightly, unless the water be very cold and freely used and the spongings frequently repeated.

*Cold Compresses.*—For this purpose three or four thicknesses of old table-linen, or towelling that is porous enough to hold a good deal of water, are required. The compress is well moistened with water of the required temperature and reapplied as soon as it becomes warm. Two compresses may be used alternately, each being cooled in turn by placing it upon a block of ice in a basin or pan at the bedside. Cold compresses of this kind are often

applied to the forehead, and usually produce sensations agreeable to the patient. They are without appreciable effect upon the general temperature. Very large compresses, extending over the entire thorax and abdomen and wet frequently with cold water, have a decided effect upon the fever.

Leiter's coils, made of thin rubber tubing, may be applied to the head, to the precordia, or other regions of the body in such a manner as to reduce the temperature locally by means of cold water flowing through them from a reservoir above the bed. They exert an influence somewhat different from that of cold compresses, and are without decided effect upon the general temperature.

Applications of ice are usually made by means of a bladder or rubber bag. The ice must be cracked into pieces about the size of a walnut and introduced into the bag with a little water, the bag being about one-half or two-thirds full. If the bag be filled with water or air sufficient to distend it, it will not conform to the part to which it is applied. Broken ice mixed with bran melts more slowly. A more effectual method of applying ice to the abdomen or over the heart consists in spreading out a thick layer of cracked ice between the folds of a coarse towel, which is then placed directly over the skin. The bed should be protected from the dripping. This method requires constant watching and is not available for prolonged use.

*The Cold Pack.*—A blanket is spread smoothly over a cot, and over it is laid a coarse sheet wrung out of water of the prescribed temperature, and doubled. The patient is lifted upon the cot thus prepared and quickly wrapped in the wet sheet by the attendant in such a manner that it conforms as closely as possible to every part of the body except the head. If the extremities feel cold before the packing they must be warmed by friction, or else not be included in the pack. As soon as the linen is everywhere in contact with the body the attendant folds the blanket over the patient in the same manner, first drawing over and tucking one side smoothly and then the other, seeing that the chin is free and that the blanket is folded evenly but without tension at the neck. Finally the end is drawn down and doubled smoothly under the feet. Three or four thicknesses of wet sheets spread upon the blanket are required to bring about a decided reduction of temperature. The fall of temperature following a single pack is usually transient, and repeated packings are often necessary, the temperature rising slowly after each. When the temperature does not rise above normal, or when shivering takes place, the pack must not be renewed. When repeated packings are necessary two cots are placed side by side, and the patient is lifted directly from one pack to the other. The same effect is produced, but less completely, by unfolding the blanket and sprinkling the sheet afresh with cold water. The patient is allowed to remain in the last pack from half an hour to an hour. At the expiration of this time he experiences a pleasant sensation of warmth, and very frequently abundant perspiration takes place. During the employment of the pack the pulse can be felt at the carotid or temporal artery, and the temperature must be taken in the mouth.

The cold or gradually cooled bath is an efficient means of reducing temperature. Employed occasionally for this purpose in cases treated symptomatically it is frequently of unquestionable advantage. Under these circumstances it is sometimes used late in the course of the disease when the temperature remains high and the condition of the patient is desperate. The favorable effects upon the nervous system are often very marked. Occasional baths thus administered for the purpose of reducing temperature, or of allaying nervous agitation in cases otherwise treated symptomatically, form no part of the method of Brand and are not to be confounded with it. Prolonged lukewarm baths are sometimes administered.

Cold affusion, the water being thrown by means of a sponge or poured from a pitcher over the patient's head, face, neck, shoulders, and chest, is sometimes practised when there is great stupor or other evidence of serious nervous derangement.

Iced-water enemata are sometimes followed by a fall of temperature. When carefully administered they are not disagreeable to patients. The water should be thrown into the rectum slowly and, in enteric fever, should not exceed 10 fluidounces (300.) for the adult.

The patient's head and face must always be bathed with cold water just before and during applications of cold to the general surface of the body. The occurrence of chilliness and shivering may be delayed by rubbing, chafing, or lightly kneading the surface of the body (forms of massage).

Thrombosis of the femoral vein should be treated by the application of a flannel bandage from the toes to the groin, the elevation of the leg and foot upon a pillow, and the control of pain when severe by hypodermic injections of morphin. After a time the establishment of a collateral circulation should be favored by daily massage, care being taken, however, to avoid the line of the occluded vein and free movement of the limb, lest a portion of the thrombus become detached. When pain and tenderness have disappeared and the patient is sufficiently convalescent to leave his bed an elastic stocking should be worn. The application of leeches to the groin and blistering in the line of the occluded vessel are useless; nor can we, in view of the pathologic condition, anticipate any favorable effects from painting with iodin, or inunctions with mercurial or other ointments.

Convalescence from enteric fever is usually slow. In many cases several months elapse before the patient regains his previous bodily and mental vigor. Exceptionally some part of the damage inflicted by the disease is permanent, the patient never regaining his full strength and powers of endurance. During the week following defervescence the temperature remains labile and is easily affected by slight causes. The recrudescences of fever at this period are abrupt and ephemeral. A transitory rise of fever is frequently symptomatic of constipation. Such a rise may follow the first eating of meat, or undue exertion even within the limits of the sick-room, or the visits of friends, or conversation upon matters of business. It is therefore important that the patient be assiduously cared for at this period. For at least a week morning

and evening temperature-observations should be made, and during this time the diet should be restricted to milk, eggs, custards, light farinaceous foods, animal broths, and jellies. Caution is to be exercised regarding the visits of friends. The consideration of matters liable to give rise to excitement or to distressing emotions should be avoided. At the end of a week ordinary light diet may be gradually resumed, but its effect upon the temperature and general condition of the patient should be carefully observed. In view of the possibility of the persistence of intestinal ulceration, nuts, seedy fruits, and other hard substances liable to pass through the intestine unchanged, are to be avoided. One of the more striking phenomena of early convalescence from enteric fever is hunger. The craving for food is often such that the patients complain bitterly of both the quantity and the quality of their sick-room fare.

If diarrhea continue it is to be treated by preparations of bismuth and small doses of opium. If there be a tendency to constipation simple salt-and-water enemata or glycerin-suppositories may be employed for its relief. Laxative medicines, with the exception of castor-oil in small doses, are not to be administered.

The general asthenia is pronounced and in many cases only slowly passes away. While it continues the patient must be regarded as an invalid and his activities kept well within the limits of fatigue and exhaustion. This is especially important in cases in which there is also marked cardiac asthenia, as shown by feeble, rapid, or irregular pulse, and faintness and dyspnea upon exertion. These conditions are due in part to changes in the nervous system, in part to changes in the nutrition of the heart-muscle itself. The latter changes frequently constitute the starting-point of degenerative processes that are progressive and give rise to serious cardiac inadequacy after the lapse of long periods of time—periods sometimes measured by years. Rest, carefully regulated; general systematic exercise, regulated with equal care; an abundant, nutritious dietary, with alternating courses of iron, arsenic, and strychnin are indicated. The judicious use of alcohol is of great service, but in the case of young persons or of those not in the habit of using alcoholic beverages, it is important to dispense with this form of stimulant as early as possible. These measures are of equal service in the management of the anemia.

Change of climate and surroundings is useful; the patient gladly escapes from the apartment that has been the scene of a tedious illness, and finds change of air and of scene invigorating alike to body and mind.

During convalescence there is often falling of the hair. In the majority of instances a new growth soon succeeds. As a matter of experience it is found undesirable to shave the head, every requirement being met by cropping the hair close to the scalp.

Under favorable conditions, with an excellent appetite and fair digestion, the convalescent from enteric fever rapidly gains in weight. Strength returns more slowly.

Furunculosis is not common early in convalescence. It seems to occur with greater frequency after the treatment by systematic cold bathing than in cases

treated by ordinary methods. The treatment consists in prompt evacuation of the pus, antiseptic dressings, and the internal administration of calcium sulphid.

At a later period local periostitis occurs in a small proportion of the cases. This process most frequently involves the periosteum of the sternum, ribs, or tibiæ. Exceptionally the inflammation undergoes resolution without suppuration. The latter event is usual, and extensive necrosis may occur. Early surgical treatment, including prompt evacuation of pus, is indicated. In a case of perichondritis, involving the lower costal cartilages on the right side, a persistent sinus healed after a series of deep injections of a solution of pyoktanin.

Peripheral neuritis is by no means a rare sequel. The lower extremities are more frequently involved. Among the earlier symptoms in many of the cases is a distressing pain in the feet and ankles, aggravated at night. Gradual loss of power follows, rarely amounting to complete paralysis, together with disturbances of sensation, wasting, lowered reflexes and impaired reaction to electric stimuli. To this condition must be referred the greater number of the cases of post-typhoid paraplegia. The treatment consists in rest, massage, electricity, and the use of cod-liver oil, iron, and minute doses of arsenic.

Spinal symptoms have recently been noted by Gibney, Osler, Eskridge, and others. The condition is comparable with that which has been described under the term hysterical or irritable spine, and sometimes with railway-spine. In some instances the clinical phenomena have been attributed to a subacute perispondylitis; in other cases the condition has been manifestly a neurosis. Treatment by rest, massage, and the application of the Paquelin cautery has been followed by improvement and recovery. In one or two of the reported cases suggestion seems to have played an important part in the rapid amelioration of the symptoms.

2. *Specific or Etiologic Plans.*—Researches having for their object the discovery of some drug possessed of positive curative properties in enteric fever comparable to those of quinin in the malarial diseases or of mercury and the iodids in syphilis have long occupied the attention of physicians. Bacteriologists and clinicians have alike labored in vain toward this goal. If here and there series of cases have been reported to show the efficacy of special methods of medication in favorably influencing the course of the disease or diminishing the death-rate, larger series of cases and dispassionate analyses of the results obtained by various observers have proved the fallacy of hasty conclusions. As to the power of any known drug to abort the disease there is now no question. Undoubted cases of spontaneous abortion are occasionally observed, but the alleged termination of enteric fever in the course of a few days as a result of some form of treatment demands the incontrovertible evidence of a large series of cases to establish its correctness. The drugs usually selected have been germicides and especially those shown in the laboratory to exert a destructive influence upon the bacilli of Eberth. According as the field of attack upon the pathogenic germ has been the intestine or the organism at large, the various plans may be grouped under the headings, *Intestinal Antisepsis* and *General Antisepsis.*

Quinin, calomel, iodin, carbolic acid, sulphurous acid, chlorin, salol, boric acid, turpentine, oil of eucalyptus, thymol, camphor, the naphthols and naphthalin, bismuth salicylate, and many other drugs have in turn been administered, on theoretic grounds, to patients suffering from enteric fever. There is ample testimony to show that under some circumstances the temporary administration of certain drugs of this class has exerted a favorable symptomatic influence upon gastro-intestinal derangements. The use of such medicaments must therefore enter into the management of the disease when conducted upon the expectant-symptomatic plan. There is no evidence, however, to show that any of them, or any combination, persistently administered throughout the course of the attack, is capable of favorably modifying the toxemia, or of uniformly abridging the duration of the attack, or notably reducing the death-rate in large series of cases.

Quinin has been used alike in large amounts and in repeated small or so-called tonic doses by various observers, and enters into the plans advocated by Yeo and Bouchard. I at one time advocated the administration of massive doses of quinin upon a falling temperature because of its effects in modifying intense pyrexia. I have, however, long since abandoned this treatment. No statistics of sufficient magnitude to carry conviction have yet been adduced in support of the view that quinin acts in enteric fever as an antiseptic or specific.

Calomel, administered in laxative doses every other night from the time the patient comes under observation until the tenth day—namely, to the extent of two, three, or at most four doses, unquestionably exerts a favorable influence upon the subsequent intestinal catarrh. This must be ascribed chiefly to its action in emptying the bowel of its accumulated contents. That it exerts any specific influence is to be doubted. The systematic administration of calomel at intervals throughout the course of the disease has long since been abandoned.

Iodin administered in connection with carbolic acid, according to the formula originally suggested by Bartholow—namely, one part of carbolic acid and two parts of compound tincture of iodin, of which two or three drops are to be given in water at intervals of two, three, or four hours, for some years occupied the attention of the profession. Concurrent testimony established the efficacy of this plan of treatment in favorably modifying the condition of the buccal and gastric mucous membrane. It is a plan of treatment still in vogue, though lacking the support of large statistics regarding its influence upon the death-rate.

Sulphurous acid, a liquid composed of about 3.5 per cent. of sulphurous-acid gas and about 96.5 per cent. of water, was many years ago used on purely theoretic grounds in the treatment of enteric fever. Although remarkable effects from its employment were claimed by Wilks, an English physician, in 1870, subsequent investigations have shown its uselessness. It has been occasionally referred to in recent systematic articles, but its use has long since been abandoned.

Chlorin has recently been advocated as a remedy in enteric fever by Yeo, who employs a solution made in the following manner: Into a 12-ounce (375.) bottle put 15 grains (1.) of powdered potassic chlorate, and pour on it 60 minims (4.) of strong hydrochloric acid. Chlorin gas is at once liberated. Fit a cork into the mouth of the bottle, and keep the vessel closed until it has become filled with the greenish-yellow gas. To hasten this you must keep shaking the mixture of acid and chlorate. Then pour water into the bottle, little by little, closing the bottle, and shaking well at each addition until the bottle is filled. You will then have a solution of free chlorin, together with some undecomposed potassic chlorate and hydrochloric acid, and probably one or two by-products. To 12 ounces (375.) of this solution we add for an adult from 24 to 36 grains (1.5–2.3) of quinin and an ounce (30.) of sirup of orange-peel, and we give an ounce (30.) every two, three, or four hours, according to the severity of the case—that will be from 12 to 36 grains (0.77–2.3) of quinin in the twenty-four hours. Yeo states that the following good effects have appeared to result from the use of this method: "1. A modification and sustained depression of the febrile temperature; 2. An abbreviation of the average course of the fever; 3. A remarkable maintenance of the physical strength and intellectual clearness of the patient, so that there has been far less need of stimulants; 4. A greater power of assimilating food; 5. A remarkable cleaning of the tongue; 6. A deodorization of the evacuations; 7. A more rapid and complete convalescence."

Salol is, upon theoretic grounds, extensively employed in the treatment of enteric fever, without other evidence in its favor than the occasional expression of the belief that it has been found an efficient intestinal antiseptic. The same statement may be made of boric acid.

Turpentine has long been used in the treatment of enteric fever, and as a result of the teaching of H. C. Wood is very extensively employed in this country. He administers it in doses of from $7\frac{1}{2}$ to 10 minims (0.46–0.62) every two hours, attributing a special value to its employment from the end of the second week. Oil of eucalyptus has been advocated upon similar grounds. Kestevan administered this remedy in doses of from 5 to 10 minims (0.31–0.62) in emulsion every four hours.

Thymol, in doses of $2\frac{1}{2}$ grains (0.16) every three hours, has been advocated by Henry on the ground of its antiseptic properties. He states that "the typical symptoms of typhoid fever will rarely develop if thymol is administered during the first week of the disease." The drug is said to be innocuous in full doses and to possess an antiseptic power four times as great as that of carbolic acid. Henry administers it in pill-form with medicinal soap as an excipient. The remarkable statement is made by Yeo[1] that "it is insoluble and thus it is certain to reach the small intestine."

Camphor has been employed by Janeway, probably more on account of its effects upon the nervous system than as an antiseptic.

Beta-naphthol has been especially advocated as a remedy in the treatment

[1] *Manual of Treatment*, vol. ii. p. 640.

of enteric fever by D. D. Stewart,[1] who administers it finely pulverized in the form of powder, wafer, capsule, or emulsion with a suitable excipient, in doses of from 5 to 10 grains (0.32–0.65) from three to five times daily. Stewart also advocates the employment of beta-naphthol salicylate and benzoate, believing that, though without germicidal power, undergoing decomposition in an alkaline medium, they will prove efficient.

Naphthalin seems to have played the part of the shuttlecock between those who found it to be a remarkable intestinal antiseptic and those who denied its efficacy in this respect, either bacteriologically or clinically. L. Wolff used it, however, in the German Hospital in Philadelphia with results that he regarded as decidedly favorable.

Bismuth salicylate has been much used by those who support the theory of intestinal antisepsis, chiefly, however, in combination with other drugs, as the naphthols and naphthalin.

Earnestly as these various drugs have been advocated, none of them can be said to have stood the test of time or to have been generally adopted by the profession. I repeat with emphasis the statement that the administration of certain drugs of the group just discussed, in cases treated upon the symptomatic plan, has been shown by the concurrent testimony of competent observers to exert a favorable influence upon the gastro-intestinal symptoms. It does not, however, follow that any of them is capable of aborting or modifying the course of the infection or diminishing the death-rate. I repeat with equal emphasis, that in view of the variations in the intensity and mortality of enteric fever in different epidemics and in different localities, large series of cases collected at different points and covering extended periods of

[1] *The Treatment of Typhoid Fever*, Detroit, 1893.

Dr. Stewart states that "Mason reports a series of 675 cases treated with hydro-naphthol (impure beta-naphthol). His results were excellent." In this connection it seems proper to quote in full from Dr. Mason's admirable article the passages relating to internal antisepsis (see *Boston Medical and Surgical Journal*, vol. cxxvi., No. 15, April 14, 1892, p. 359):

"Internal antisepsis by the use of minute doses of calomel, salol in 5-grain doses several times daily, naphthalin, salicylate of bismuth and naphthol, has been attempted in a more or less systematic manner at the City Hospital. Of these agents hydro-naphthol in doses of from 2 to 4 grains every two hours has appeared to have influence in modifying diarrhea and the offensive character of the stools. But it is doubtful whether the infecting germs and poisonous alkaloids can be effectually neutralized in this way by any harmless agent.

"*Hydro-naphthol.*—Between May 9, 1891, and January 1, 1892, 103 cases of typhoid were admitted to the second medical service, 83 males and 20 females; 48 had diarrhea, 55 had not; 45 were treated with hydro-naphthol, 58 were treated without hydro-naphthol. Of the former series two died; of the latter series seven died. None of those who used hydro-naphthol had hemorrhage from the bowels, while three of the others had. In 27 patients diarrhea diminished or ceased while using this drug, often after a few days, sometimes not for two weeks. Relapse took place in 6 patients who were treated without hydro-naphthol and in 4 who took this drug. About 30 patients, without regard to the presence or absence of diarrhea, were treated from the time of admission continuously with hydro-naphthol, at first every two hours, later every four or six hours, until convalescence was well established, in the hope of preventing relapse. Two of these patients had relapses, nevertheless, and one died with symptoms of perforation of the bowel. No ill-effects attributable to the drug itself were noticed in any case. These facts were tabulated by Dr. Benjamin Tenney, house-physician, who watched all the cases."

time are necessary to establish the efficacy of any particular treatment. There is abundant reason for grave doubt that any of the drugs mentioned, administered in ordinary doses, exerts a positive germicidal action in the bowel, and it has been sufficiently established that certain of them are insoluble in the contents of the bowel.

It has been demonstrated that the pathogenic bacilli do not appear in the stools earlier than the tenth day, very often not before the sixteenth or seventeenth day; and the assumption is warranted that the bacilli to which the infection in any given case is due have entered the lymph-structures of the intestine during the period of incubation and already, at the time of the manifestation of the symptoms, are growing in Peyer's patches, the mesenteric glands, the spleen, the lymph-elements of the liver and other organs of the body. The toxins that result from that growth are evolved within the tissues of the organism itself, not in the intestinal canal. Intestinal antisepsis, in so far as the pathogenic organisms of enteric fever are concerned, is therefore directed against germs not present in the bowel prior to the breaking down of the intestinal lymph-elements, and must, for that reason, be largely inoperative.

General antisepsis, in so far as any possible germicidal influence upon bacterial forms diffusely implanted in the lymph-tissues throughout the organism is concerned, is a vain fancy wholly unsupported by facts. The parasite is more resistant to such influences than the host. From clinical and pathologic considerations alike, the whole subject of the antiseptic treatment of enteric fever falls to the ground.

3. *The Method of Hydrotherapy.*—Currie of Liverpool as early as 1797, and Nathan Smith of Yale College about the same time, advocated the use of cold water in the treatment of the more serious symptoms of the fevers. Their method consisted chiefly in cold affusion, though sponging was also employed. The teachings of these physicians were not generally accepted, and although during the past century various forms of hydrotherapy have been applied to the treatment of the fevers, and especially in combating high temperature, it remained for Ernst Brand of Stettin to formulate a definite procedure for the treatment of enteric fever by systematic cold bathing.

Brand's first publication upon this subject was made in 1861. The method made but slow progress in Germany until toward the close of the Franco-Prussian war in 1871. About this time it was introduced at Lyons by the French military surgeons who, as prisoners of war, had seen it practised at Stettin. Within recent years it has been very extensively adopted in hospital practice and to some extent also in private practice.

The treatment of enteric fever by systematic cold bathing according to the method of Brand has been practised continuously in the German Hospital of Philadelphia since I introduced it in my service there on the first of February, 1890. It has been the only treatment employed and all patients suffering from this disease have been submitted to it, except very rare cases in which the axillary temperature has not reached 101.5° F. (38.6° C.), those brought in moribund, and those admitted late in the course of the attack—during or after the

third week. The details of the method, which, with the exception of some minor particulars, is that formulated by Brand, are as follows:

The patient receives a full bath at about the temperature of the ward every three hours when the thermometer placed in the rectum registers 102.2° F. (39° C.), or over. When axillary temperatures are taken the bath is administered at the end of the third hour if the temperature exceeds 101.5° F. (38.6° C.). The temperature of the bath standing in the ward varies between 65° and 70° F. (18.3°–21.1° C.); if in very warm weather it be found higher than 70° (21.1° C.) it is cooled to that point by the addition of ice or freshly drawn water. Shortly after the patient has fully reacted, usually in half or three-quarters of an hour, his temperature is frequently again taken in order to determine the effect of the individual bath. This is not, however, necessary and is very often omitted, especially if the patient be already asleep. The patient remains in the bath, as a rule, fifteen minutes, during which time he is systematically rubbed by the attendants and encouraged to rub himself. For this purpose the nurses use their bare hands or bath-gloves. These frictions stimulate the peripheral circulation, constantly change the water in contact with particular points of the surface, moderate the sensation of cold and, as Glénard has remarked, help to pass the time. If the pyrexia be high, the temperature before the bath exceeding 104° F. (40° C.), or rising very rapidly after the bath, or if it be but little influenced by the bath, the immersion is prolonged to twenty or, in unusual cases, to twenty-one or twenty-two minutes.

The tub, which is upon wheels, is placed at the side of the bed and parallel to it at the distance of about a yard. Both are surrounded by ward-screens of white muslin upon iron frames, leaving sufficient room for the attendants. The patient's night-dress is removed under the bed-covering, his body is covered with a sheet, or a large folded napkin is placed about the loins, and he is lifted from the bed into the bath. Many of the patients in whom the treatment is instituted early in the attack, or in whom for other reasons the symptoms are comparatively mild, prefer to rise and step into the tub with the assistance of the attendants, and no harm has ever been observed to result from permitting them to do so. If the patient be asleep he is not bathed immediately, but fifteen or twenty minutes are permitted to elapse after he is aroused. If he be sweating his skin is thoroughly dried before the bath. The tub is lined with planished copper, perfectly smooth. There is a sloping support for the shoulders and head of the patient, which, moreover, rest upon a rubber air-cushion. The water, usually about thirty gallons for an adult, is sufficient to cover the patient to the neck. Upon entering the bath he receives an ounce of spirit well diluted, or half a glass of red wine, or either of these may be administered in divided amounts during the bath. His head and face are bathed immediately and repeatedly with cold water, and a compress wet with the same is applied to his forehead; a basin and pitcher of cold water are at hand for this purpose. In cases with high temperature or marked nervous symptoms the cold water is very often poured from time to time over the head and face from the height of a few inches.

Upon entering the bath the respirations are suddenly deepened. After the first shock the sensations are for a time not disagreeable, but in five or six minutes the patient begins to be restless and complains of cold. In ten or twelve minutes shivering takes place. About the same time the extremities and face become slightly cyanotic. While the patient is in the bath his bed is covered with a rubber sheet, this with a blanket, and over both is laid an ordinary ward-sheet. The patient is lifted out, laid upon the bed thus arranged, closely tucked in the sheet and covered with the blanket. In the course of ten or fifteen minutes he is thoroughly dried and his night-dress is replaced. About this time reaction is usually established, the patient receives nourishment in the form of milk or broth, and quickly falls into a gentle sleep. When there is marked cardiac asthenia, or if for any other cause reaction is retarded, the patient should be dried at once beneath the blanket, receive a hot toddy and have a hot-water bag placed in contact with his feet. The condition of the patient is carefully watched during the bath, and its duration is shortened if its immediate effects, as manifested by shivering, cyanosis, and restlessness, are too pronounced.

The German Hospital has a wheeled tub (Fig. 7) for each of the small

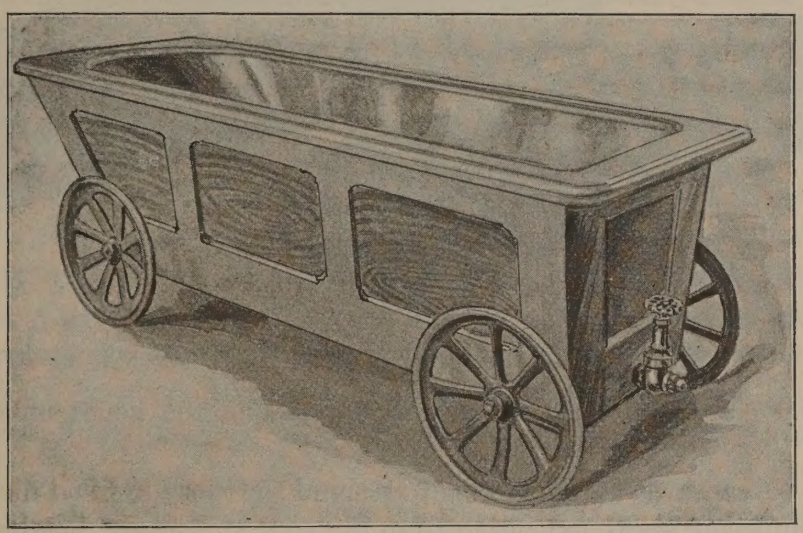


FIG. 7.—Wheeled tub.

wards set apart for the enteric-fever cases. Several forms of portable tubs are supplied by dealers. An ordinary tub may be placed upon a low truck or platform upon wheels. In private practice the portable tub of Dr. Batt is convenient for immediate use (Fig. 8).[1] There is no difficulty, however, in

[1] Dimensions of tub when ready for use: length, 6 ft. 3 in.; width, 22 in.; depth, 18 in. Dimensions of tub when folded for carrying: length, 2 ft. 9 in.; thickness, 9 in. Dimensions of box containing frame: length, 3 ft. 3 in.; width, 8 in.; depth, 3 in. The tub part is composed of heavy canvas covered with rubber, is seamless, and has a tensile strength of 350 pounds. The tub is supported by hooks inserted through the canvas before the rubber is applied. The frame is composed of brass pipe nickel-plated. Both tub and frame can be rendered aseptic by boiling.

procuring from a plumber an ordinary tub, which may remain permanently by the bedside of the patient, being filled noiselessly and with but little trouble by means of rubber tubing from the faucet in the neighboring bath-room, and emptied by the same tube used as a siphon out at the window or

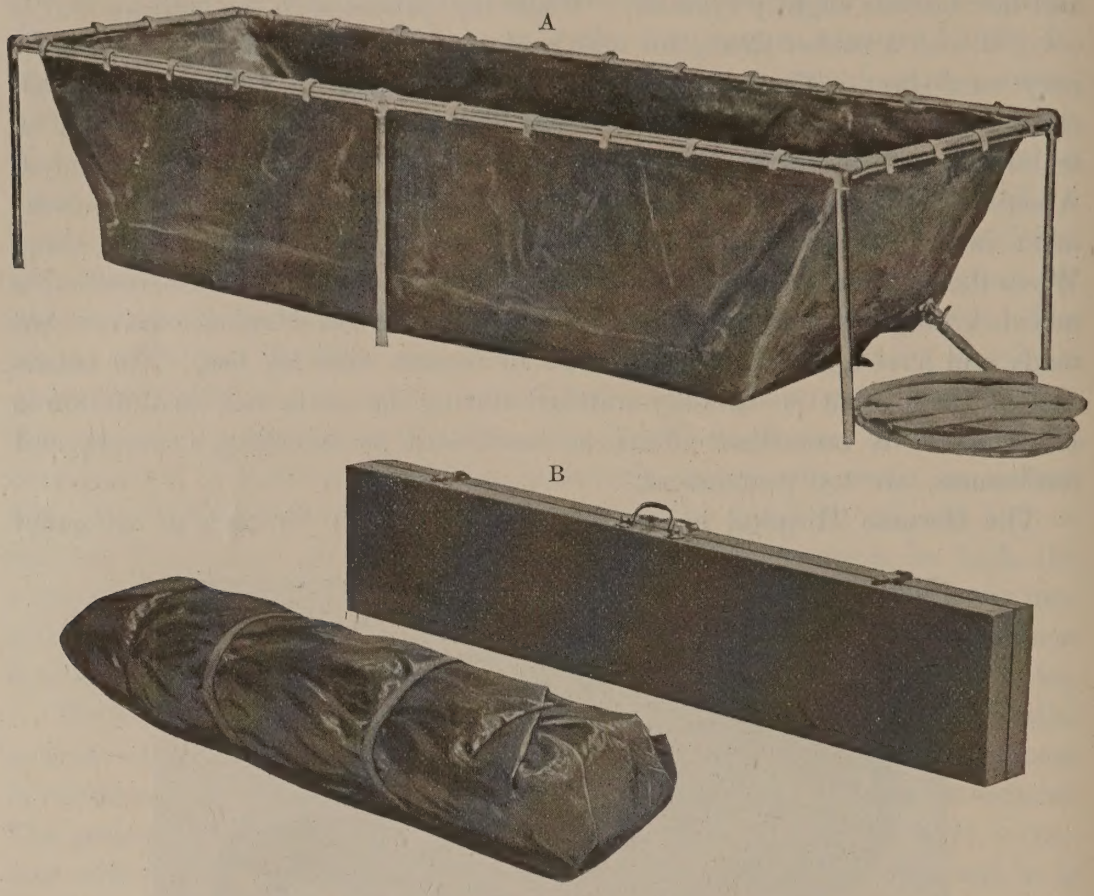



FIG. 8.—Portable bath-tub: A, open, ready for use; B, folded, for transportation.

into a basin connecting with the drainage-system of the house upon the floor below.

In the fever-wards of the German Hospital the tubs are filled directly from a tap of sufficient length extending from the wall at a proper height, and they are emptied at the same point directly into a waste-way in the floor, the wall and floor being lined with slate or tiling.

For a single patient, as occurs usually in private practice, the water should be changed once in twenty-four hours. In hospital practice, especially when a number of cases are being treated, it becomes necessary to bathe several patients in the same water. After the sixth bath the water should be changed. The patients always void urine immediately before the bath, and I have never known an instance in which fecal incontinence occurred during the bath. It is desirable to have two attendants for the administration of the bath, though under ordinary circumstances, when the patients are in a condition to assist themselves, the bath may be administered by a single attendant. When there are a large number of cases in hospital-wards, as frequently occurs at the time

of the epidemic prevalence of the disease, the administration of the baths becomes very laborious and a correspondingly large staff of nurses is required. During the bath the temperature of the water is slightly raised, the change amounting to from 2° to 3° F. (1.1° to 1.6° C.) The frequency of the bath is determined by the effect upon the patient's temperature. If at the end of three hours the temperature remains below 101.5° F. (38.6° C.) in the axilla, or 102.2° F. (39° C.) in the rectum, the patient is not disturbed until his temperature is again taken at the end of another period of three hours. If, however, nervous symptoms arise during the second period of three hours, or manifest increase of fever is present, the temperature is taken sooner and the bath administered at once according to rule. Milder cases and those with declining temperatures may require only two or three baths in the course of the twenty-four hours. Early cases and those with high temperature are subjected to the bath every third hour, alike during the day and night, and it sometimes happens that these frequent baths are necessary for several days in succession.

Patients admitted prior to the tenth day of the attack receive one or more laxative doses of calomel. Other drugs are ordinarily not administered, and a majority of the patients reach convalescence without a single dose of medicine. The maxim that the patient rather than the disease is to be treated is, however, constantly borne in mind, and when the indications have arisen I have not hesitated to administer increased doses of alcohol, and aromatic spirit of ammonia, strychnin, opium, etc. in full doses. The necessity for medication has, however, in my own service been very infrequent.

The diet has been that already detailed. It has not only been possible to give it in larger amounts than under the ordinary expectant method of treatment, but patients frequently crave and demand food throughout the attack. In such cases two or more raw eggs a day are added to the milk and broth ordinarily administered. During convalescence red wine and preparations of iron, especially Basham's mixture of iron and ammonium acetate, are administered. No solid food is given until the evening temperature has been normal for a week.

Brand has especially insisted upon the importance of the cold-bath treatment from the very onset of the attack, and has collected abundant statistics to show that the mortality is reduced to a minimum in cases in which the treatment is instituted prior to the fifth day. In civil practice, except in local epidemics, the positive diagnosis of enteric fever can rarely be made as early as the fifth day. In hospital practice only a small proportion of the enteric-fever cases are admitted before the fifth day. In the service of the German Hospital patients are subjected to the bath-treatment if, upon admission, the diagnosis of enteric fever is probable or becomes so by exclusion. Under this practice errors of diagnosis have in a few instances led us to bathe patients who subsequently proved to be suffering from pneumonia, influenza, or other acute febrile diseases.

In by far the greater number of instances the date of the beginning of the fever can only be determined approximately. Only exceptionally does the

disease begin with an abruptness that fixes definitely the day or hour of its onset. The general rule in taking the clinical notes has been to date the beginning of the attack from the day on which the patient regarded himself as having fever, or on which he was obliged to give up his occupation. The appearance of the eruption and the enlargement of the spleen, which may usually be noted on the seventh or eighth day, rarely as early as the sixth and seldom as late as the tenth, are events that aid in fixing the date of onset.

The following statistics, though based on a relatively small number of cases, support the generally accepted statement of Brand, that the influence of the treatment upon the mortality is proportionately favorable as it is instituted early in the course of the attack:

In Series No. 4, 12 cases were admitted on or before the fifth day; one of these died fifteen days later, of a complicating meningitis. Thirty-six cases were admitted before the tenth day; of these 2 died, giving a mortality of 5.5 per cent. Six were admitted after the tenth day, with one death, giving a mortality of 16 per cent. The day of admission was not noted in 24 cases.

In Series No. 5, 20 cases were admitted on or before the fifth day of the disease; of these none died. Forty-two cases were admitted prior to the tenth day; of these 4 died, giving a mortality of 9.5 per cent. Twelve cases were admitted after the tenth day; of these 3 died, giving a mortality of 25 per cent. The day of the disease upon which the patient was admitted to the hospital was not noted in 20 cases.

Taking Series 4 and 5 together, we note that of 32 cases admitted not later than the fifth day, 1, or about 3 per cent., terminated fatally. In 78 cases admitted prior to the tenth day the death-rate was 7.7 per cent.; and in 18 cases admitted after the tenth day the death-rate was 22 per cent.

Neither age, sex, menstruation, pregnancy, nor the free sweating that attends many cases is regarded as a contra-indication to the systematic treatment by cold baths or as calling for any modification of it. I have not hesitated to administer the baths in cases admitted with broncho-pneumonia and croupous pneumonia as complications, nor have I modified the treatment when these conditions developed subsequently. Upon the occurrence of hemorrhage the baths have invariably been discontinued for a time, and in some instances abandoned altogether. Upon the appearance of the signs of peritonitis the baths have been discontinued at once. Diarrhea has rarely been a troublesome symptom; it has been treated simply by the application of large cold-water compresses or ice-poultices to the abdomen. When necessary, constipation has been relieved by enemata. When the temperature no longer exceeds 101.5° F. (38.6° C.) the baths are discontinued and the patient is treated as a convalescent, being kept, however, in bed and upon a liquid diet until the evening temperature has been normal for a week. He is then allowed to spend part of the day in a chair; in a short time he is allowed to walk about and in suitable weather to go into the open air. In uncomplicated cases the convalescence has, in most instances, been more rapid than after other methods of treatment,

and the patients have, as a rule, returned to their homes within two weeks after the completion of the defervescence.

The treatment stands by itself as a definite procedure, not to be confounded with the treatment of enteric fever by graduated baths, the cold pack, cold affusions, spraying, continuous immersion, and other hydro-therapeutic measures. It is especially to be looked upon as a method entirely distinct and different from any merely antipyretic treatment. Upon this Brand and those who have followed him insist.

Submitted to the first of the tests of the value of a method of treatment to which I have referred, namely, its effect upon the general course of the disease in series of cases, the method of Brand yields very satisfactory results. Brand declares that in cases treated from the beginning, that is, before the fifth day, the classic picture of typhoid fever is no longer seen; that there remains of ordinary typhoid nothing more than (*a*) a moderate fever, (*b*) an unimportant bronchial catarrh, (*c*) enlargement of the spleen, (*d*) the rose-rash, and (*e*) infiltration of the intestinal glands. Many of the more serious symptoms are prevented and the disease runs a comparatively mild course, which is, as a rule, but little abridged. Unfortunately, the cases rarely present themselves as early as the fifth day, but the effect of the treatment is shown in cases in which it is instituted at a later period, even so late as the middle of the second week. As a rule, after six or eight baths a striking modification of the clinical picture takes place. Headache disappears, delirium ceases, stupor is replaced by long stages of natural sleep, from which the patient is easily aroused, with a bright expression and a clear mind; tremor is rarely seen; the tongue becomes moist and clean, and remains so; there is a desire for food, and very commonly, even in the midst of the attack, the patient complains of hunger; the abdomen is not tympanitic; diarrhea is rarely excessive or troublesome.

In series No. 4, hemorrhage occurred in three among sixty-six cases; in series No. 5, in seven among seventy-four cases; that is to say, intestinal hemorrhage occurred in ten among one hundred and forty cases, or in 7 per cent.

The effect of the baths upon the respiratory system cannot be viewed as other than favorable. The deep inspirations immediately following the immersion of the patient's body and excited by the application of cold water to his face, neck, and the upper part of his chest while in the bath, fulfil an important indication in the management of the disease, and the rhythmic repetition of this process at successive periods of three hours tends to diminish the danger of pulmonary complications, to fully expand the peripheral air-vesicles, and to prevent hypostasis. The bronchitis that constitutes an important part of the pathologic process is improved rather than aggravated, and the frequency of the occurrence of broncho-pneumonia and pleurisy is certainly not increased. During the baths the favorable influence upon the respiration is to some extent maintained.

Upon the circulatory system the cold bath exerts an immediate effect. Shortly after immersion the relaxed, dicrotic pulse shows increased tension

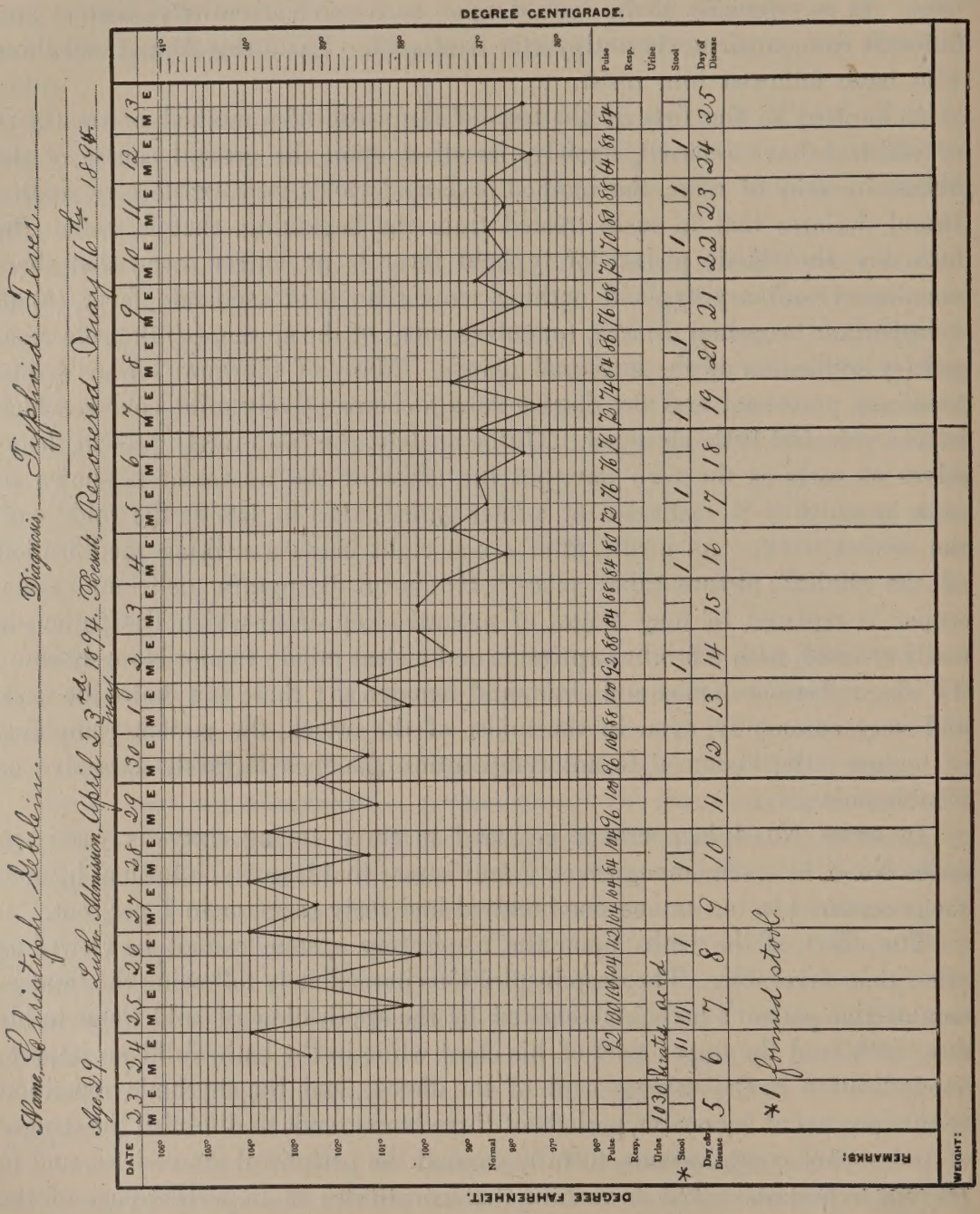



FIG. 9.—Mild case of enteric fever treated by cold bathing.

Name, Christoph Gebelein Sister,

| Date, | Temp. of Room. | Time. | Temp. of Patient. | Resp. | Pulse. | Bowels. | Medicine and Dose. | Bath No. | STIMULANT. Kind and Amount. | FOOD. Kind and Amount. | Other Prescriptions. | Urine, Sleep, Mind, Cough, Perspiration, Vomiting, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr. 28 | | 5 p. m. | 103 3/5 | | 104 | | | 1. | Whisky fʒ fs | | | |
| | | 5:30 p. m. | 101 1/5 | | 96 | | | | " " " | | | |
| | | 6 p. m | | | | | | | | Milk & Egg | | |
| | | 8 p. m. | 104 | | 100 | | | 2. | Whisky fʒ fs | | | |
| | | 8:30 p. m | 101 3/5 | | 96 | | | | " " " | | | |
| | | 11 p. m | 103 | | 100 | | | 3. | Whisky fʒ fs | Milk ʒ VII | | |
| | | 11:30 p. m | 101 | | 96 | | | | " " " | | | |
| Apr. 29 | | 2 a. m | 102 3/5 | | 100 | | | 4. | Whisky fʒ fs | Milk ʒ VII | | |
| | | 2:30 a. m | 100 1/5 | | 88 | | | | " " " | | | |
| | | 5 a. m | 101 | | 96 | | | | Whisky fʒ fs | | | |
| | | 7 a. m | | | | | | | | Milk & Egg ʒ VII | | |
| | | 8 a. m. | 101 3/5 | | 96 | | | | Whisky fʒ fs | | | |
| | | 10 a. m. | | | | | | | | Milk ʒ VII | | |
| | | 11 a. m. | 101 3/5 | | 100 | | | | Whisky fʒ fs | | | |
| | | 12 noon. | | | | | | | | Broth & Egg | | |
| | | 2 p. m. | 102 | | 108 | | | | Whisky fʒ fs | | | |
| | | 3 p. m. | | | | | | | | Milk ʒ VII. | | |
| | | 5 p. m. | 102 3/5 | | 100 | | | 5 | Whisky fʒ fs | | | |
| | | 5:30 p. m | 101 3/5 | | 92 | | | | " " " | | | |
| | | 6 p. m. | | | | | | | | Milk & Egg | | |
| | | 8 p. m. | 102 3/5 | | 104 | | | 6 | Whisky fʒ fs | | | |
| | | 8:30 p. m. | 100 3/5 | | 92 | | | | " " " | | | |
| | | 11 p. m | 102 3/5 | | 96. | | | 7. | Whisky fʒ fs | Milk ʒ VII. | | |
| | | 11:30 p. m | 99 1/5 | | 96 | | | | " " " | | | |
| Apr. 30 | | 2 a. m. | 102 3/5 | | 104 | | | 8. | " " " | Milk ʒ VII | | |
| | | 2:30 a. m | 99 | | 96 | | | | " " " | | | |
| | | 5 a. m | 101 3/5 | | 96. | | | | " " " | | | |
| | | 7 a. m | | | | | | | | Milk & Egg. | | |
| | | 8 a. m | 101 | | 98 | | | | Whisky fʒ fs | | | |
| | | 10 a. m. | | | | | | | | Milk ʒ VII. | | |

Name, Christoph Gebelein Sister,

| Date. | Temp. of Room. | Time. | Temp. of Patient. | Resp. | Pulse. | Bowels. | Medicine and Dose. | Bath No. | STIMULANT. Kind and Amount. | FOOD. Kind and Amount. | Other Prescriptions. | Urine, Sleep, Mind, Cough, Perspiration, Vomiting, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Apr. 30 | | 11 a m | 101 3/5 | | 88 | | | | Whisky f℥ss | | | |
| | | 12 noon. | | | | | | | | Broth & Egg | | |
| | | 2 p. m. | 102 | | 102 | | | | Whisky f℥ss | | | |
| | | 3 p. m. | | | | | | | | Milk ℥ VIII | | |
| | | 5 p. m. | 103 | | 106 | | | 9 | Whisky f℥ss | | | |
| | | 5 30 p. m. | 100 | | 94 | | | | " " " | | | |
| | | 6 p. m. | | | | | | | | Milk & Egg. | | |
| | | 8 p. m. | 102 3/5 | | 108 | | | 10 | Whisky f℥ss. | | | |
| | | 8 30 p. m. | 99 | | 92 | | | | " " " | | | |
| | | 11 p. m. | 101 | | 96 | | | | Whisky f℥ss | Milk ℥ VII | | |
| May 1. | | 2 a. m. | 101 | | 96 | | | | " " " | " " | | |
| | | 5 a. m. | 100 1/5 | | 88 | | | | " " " | | | |
| | | 7 a. m. | | | | | | | | Milk & Egg. | | |
| | | 8 a. m. | 100 1/5 | | 96 | | | | Whisky f℥ss. | | | |
| | | 10 a. m. | | | | | | | | Milk ℥ VII | | |
| | | 11 a. m | 100 | | 90 | | | | Whisky f℥ss | | | |
| | | 12 noon. | | | | | | | | Broth & Egg | | |
| | | 2 p. m. | 101 3/5 | | 100 | | | | Whisky f℥ss. | | | |
| | | 3 p. m. | | | | | | | | Milk ℥ VII | | |
| | | 3 p. m. | 101 3/5 | | 100 | | | | Whisky f℥ss | | | |
| | | 6 p. m. | | | | | | | | Milk & Egg. | | |
| | | 8 p. m. | 101 4/5 | | 112 | | | | Whisky f℥ss. | | | |
| | | 11 p. m. | 101 4/5 | | 108 | | | | " " " | Milk ℥ VII | | |
| May 2d | | 2 a. m. | 101 3/5 | | 100 | | | | " " " | " " " | | |
| | | 5 a. m. | 98 3/5 | | 92 | | | | " " " | | | |
| | | 7 a. m. | | | | | | | | Milk & Egg. | | |
| | | 8 a. m. | 100 | | 90 | | | | Whisky f℥ss | | | |

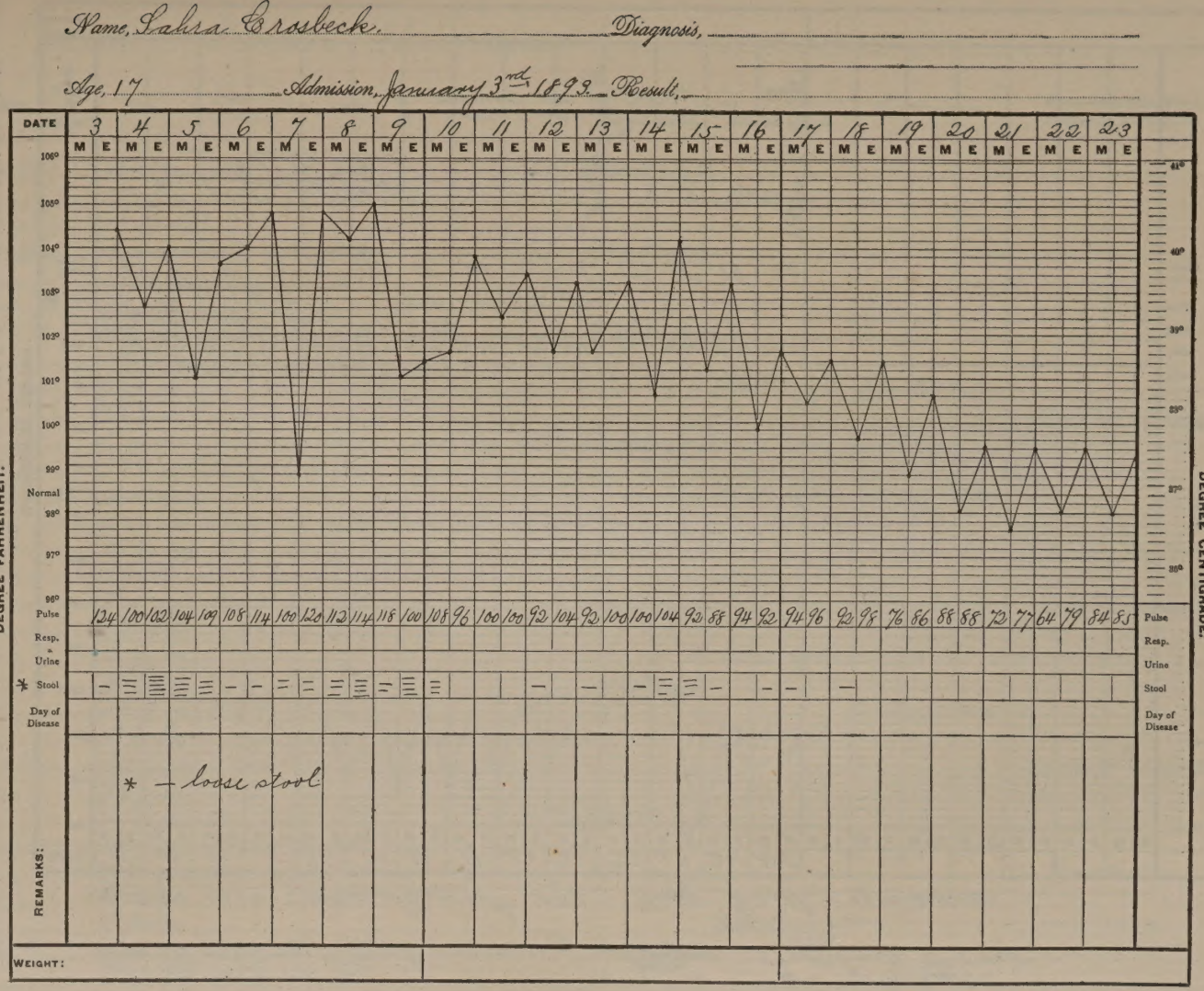



Fig. 10.—Chart showing general modification of lysis in a case of enteric fever treated with cold baths.

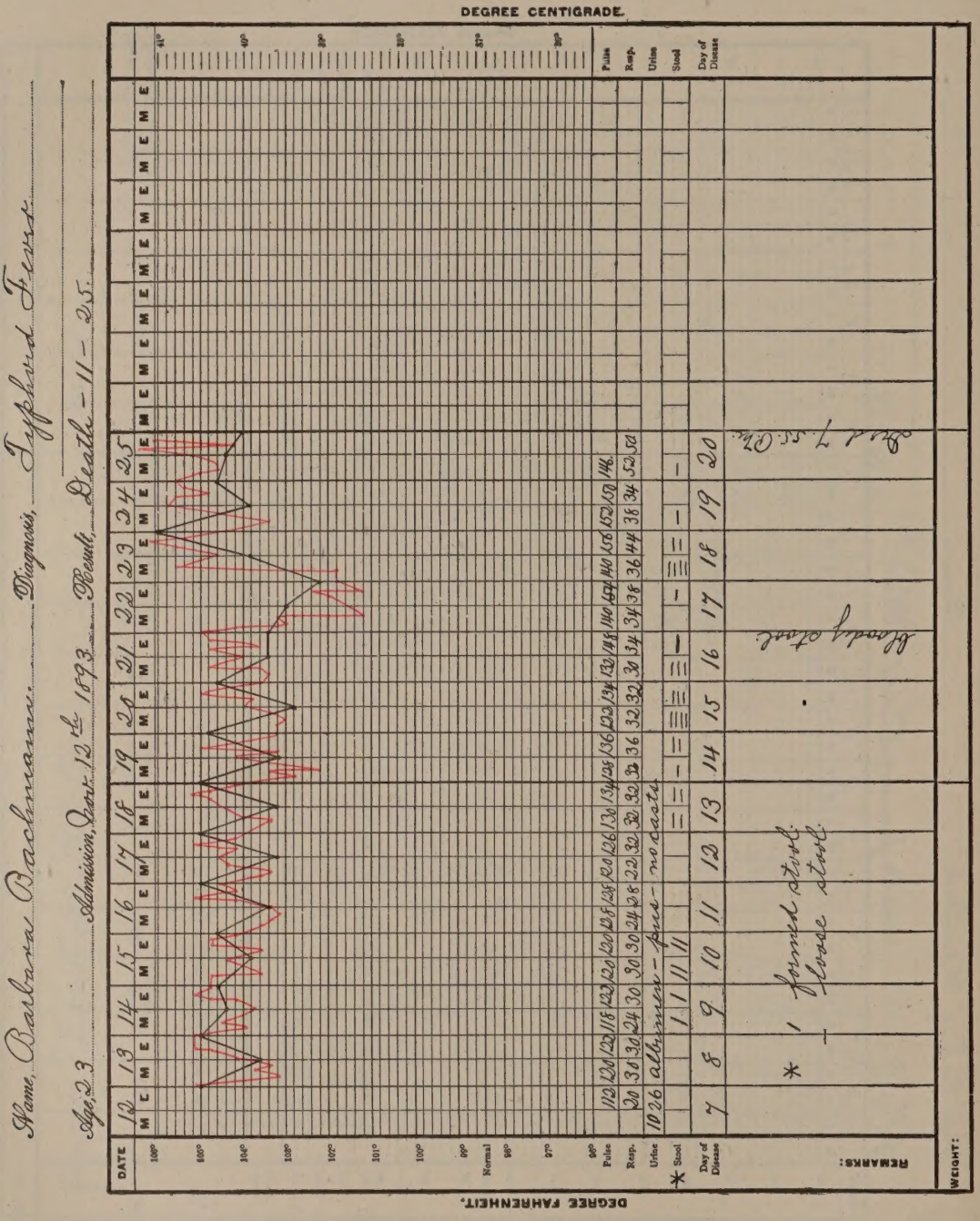



FIG. 11.—Fatal case of enteric fever treated by cold baths. High temperature but slightly influenced by baths. The red dots and lines show the course of the temperature as influenced by the individual baths; the black dots show the morning and evening temperatures.

Name, Barbara Bachmann Sister,

| Date. | Temp. of Room. | Time. | Temp. of Patient. | Resp. | Pulse. | Bowels. | Medicine and Dose. | Bath No. | STIMULANT. Kind and Amount. | FOOD. Kind and Amount. | Other Prescriptions. | Urine, Sleep, Mind, Cough, Perspiration, Vomiting, etc. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nov. 12 | | 11 p.m. | 105 | 30 | 118 | | | 1 | Whisky fʒfs | | | |
| | | 11 30 p.m. | 103 4/5 | 24 | 112 | | | | " " " | Milk fʒv. | | |
| | | 12 midn. | | | | | | | | | | |
| Nov. 13. | | 2 a.m. | 103 | 22 | 114 | | | 2. | Whisky fʒfs | | | |
| | | 2 30 a.m. | 102 4/5 | 26 | 120 | | | | " " " | | | |
| | | 3 a.m. | | | | 1 | | | | | | |
| | | 5 a.m. | 103 3/5 | 30 | 120 | | | 3. | Whisky fʒfs | | | |
| | | 5 30 a.m. | 102 3/5 | 24 | 108 | | | | " " " | | | |
| | | 6 a.m. | | | | | | | | Milk fʒv. | Ice-bag to head. | |
| | | 6 30 a.m. | | | | | | | | | | passed urine. |
| | | 8 a.m. | 103 3/5 | 28 | 108 | | | 4. | Whisky fʒfs | | | |
| | | 8 30 a.m. | 102 3/5 | 24 | 100 | | | | " " " | | | |
| | | 10 a.m. | | | | | | | | Milk fʒv. | Ice. bag to head. | |
| | | 11 a.m. | 104 | 30 | 120 | | | 5. | Whisky fʒfs | | | |
| | | 11 30 a.m. | 103 | 28 | 110 | | | | " " " | | | vomited |
| | | 1 p.m. | | | | | | | | Milk fʒv. | | |
| | | 2 p.m. | 104 3/5 | 30 | 122 | | | 6. | Whisky fʒfs | | Ice-bag to head | passed urine. |
| | | 2 30 p.m. | 103 3/5 | 28 | 114 | | | | " " " | | | |
| | | 4 p.m. | | | | | | | | Milk fʒv. | | |
| | | 5 p.m. | 105 | 30 | 122 | | | 7. | Whisky fʒfs | | | |
| | | 5 30 p.m. | 102 3/5 | 28 | 116 | | | | " " " | | Ice-bag to head. | |
| | | 6 p.m. | | | | | | | | Milk fʒv. | | |
| | | 6 30 p.m. | | | | | | | | | | passed urine. |
| | | 7 45 p.m. | | | | | | | | | | " " " " |
| | | 8 p.m. | 105 | 28 | 120 | | | 8. | Whisky fʒfs | | | |
| | | 8 30 p.m. | 104 3/5 | 28 | 114 | | | | " " " | | Ice-bag to head | |
| | | 11 p.m. | 105 | 24 | 120 | | | 9. | Whisky fʒfs | | | vomited. |
| | | 11 30 p.m. | 103 1/5 | 26 | 112 | | | | " " " | | Ice-bag to head. | |
| | | 12 midn. | | | | | | | | Milk & Limeo fʒv. | | |
| Nov. 14. | | 2 a.m. | 103 4/5 | 30 | 132 | | | 10. | Whisky fʒfs | | | |
| | | 2 30 a.m. | 103 3/5 | 24 | 110 | | | | " " " | | Ice-bag to head. | |

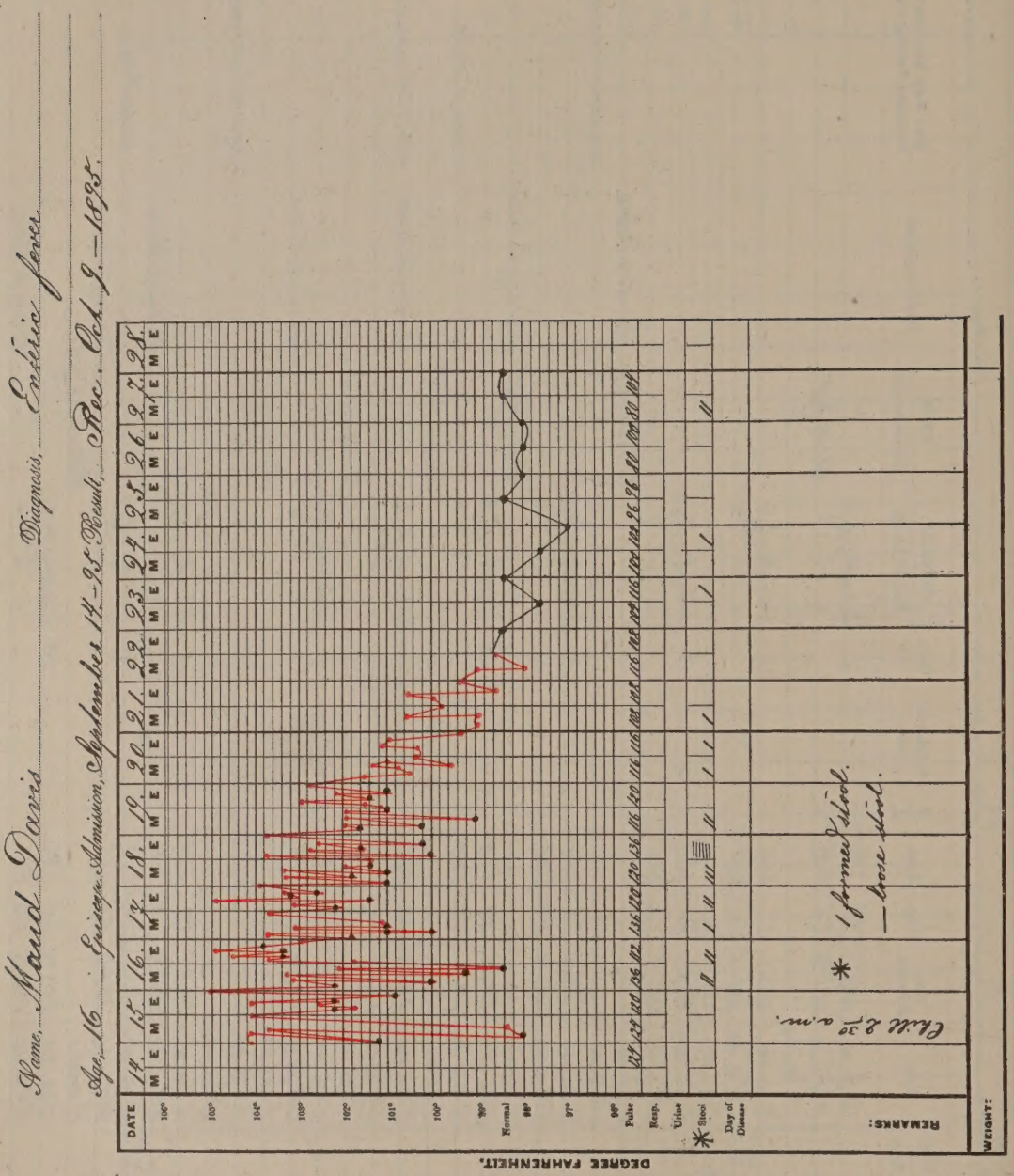



FIG. 12.—Temperature-chart of a case of enteric fever treated with cold baths and terminating in recovery. The black dots show the influence of the individual baths upon the temperature.

and becomes small, firm, and less frequent—a change that is maintained for some time after the patient has been taken out of the bath and put to bed. In severe cases, and especially in those in which the treatment is instituted comparatively late in the course of the disease, symptoms of collapse may occur. Under these circumstances the duration of the bath must be reduced to five or even three minutes, and occasionally, as in an instance (to be presently referred to) under the care of my colleague, Dr. Trau, the baths must, for a time at least, be wholly abandoned.

The secretion of urine is usually increased; in some instances, however, owing to diminution of thirst and consequent reduction in the ingestion of fluid, the daily amount of urine was lowered. Slight, transient albuminuria, without casts, has been observed occasionally.

The effect upon the febrile movement is decided, the fall of temperature, as taken in the rectum fifteen minutes after the bath, ranging from 1° to 4° F. (0.5°–2.2° C.). In some instances the reduction is even greater than this, and exceptionally a fall of 6° F. (3.3° C.) or even 7° F. (3.9° C.) has been observed. This fall is usually followed by a gradual rise, the fastigium being, as a rule, attained at the expiration of two or three hours. The reduction of temperature by the single bath is much less in the early than in the later course of the disease and the succeeding rise is much more rapid. It is in accordance with these facts that in the early course of the disease, and particularly in cases marked by early high temperature, the antipyretic effect of individual baths and of the treatment as a whole is much less pronounced than later, although the effect upon the nervous symptoms and upon the pulse is very marked. In some cases the effect upon the temperature remains slight for several days. Much more frequently decided falls and more gradual rises are observed after a series of six or ten baths have been administered. In children the reduction is greater and more rapid than in adults. A striking modification of the general temperature-curve is shown in the form of the lysis, which is usually prolonged and gradual, covering a period of eight or ten days from the end of the second week and contrasting strongly with the remittent fever-curve of this period of the attack as seen under ordinary methods of treatment. In cases of average intensity and in severe cases the duration of the attack does not appear to be abridged. The course of the fever is, however, unquestionably shortened in the milder cases, so that the charts show a considerable proportion of short cases and a few abortive cases. Convalescence is shortened and sequels are notably infrequent. The accompanying charts (Figs. 9–12) and reproductions of the bedside-notes illustrate the foregoing statements.

I have reported a case[1] in which the opportunity occurred to observe in the same individual the comparative effects of the cold baths and cold packs:

A lad eighteen years of age was admitted on the eighth day of an extremely severe attack of enteric fever, characterized by great elevation of temperature. The circulation was feeble, and while the effect of the baths upon the temperature was favorable, the subsequent reaction was unsatisfactory, and the prolonged

[1] *International Clinics*, July, 1891.

lividity of the extremities and the profound weakness led my colleague, Dr. Trau, to whose care the patient was transferred upon the change of service, to substitute cold packs for the bath, as involving less disturbance. This change, which took place at the end of the second week, enabled us to compare the effect of the baths with that of cold packs. The temperature-chart of this case (Fig. 13) shows a general effect upon the temperature-range as made up

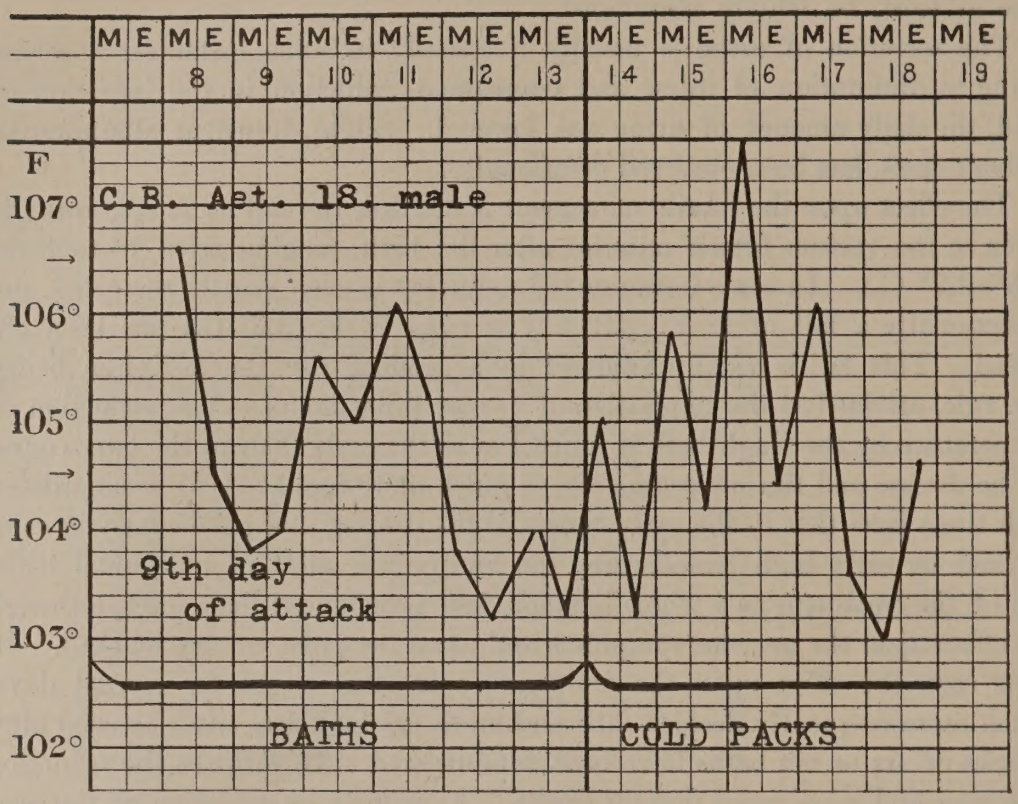

M E M E M E M E M E M E M E M E M E M E M E M E M E M E
8 9 10 11 12 13 14 15 16 17 18 19
F
107°
C.B. Aet. 18. male
106°
105°
104°
9th day
of attack
103°
102°
BATHS
COLD PACKS

FIG. 13.—Temperature-curve showing the relative influence of cold baths and cold packs.

from the morning and evening observations; the table on page 239 shows the immediate effect of each bath during a period of six days, and of each pack during a subsequent period of six days.

As will be seen by the chart, the temperature had fallen during the bathing, but rose again immediately and notably on the substitution of the packs, reaching three days later 107.6° F. (42° C.), its type having become inverse. The study of the table shows an average reduction of temperature after bathing of 3° F. (1.6° C.), a maximum of 7° F. (3.9° C.) and a minimum of 0.8° F. (0.4° C.), whereas the average reduction of the packs was 2.8° F. (1.6° C.), the maximum 5° F. (2.8° C.) and the minimum 1° F. (0.5° C.). The patient recovered.

In 408 cases treated in the German Hospital according to this plan up to October 1, 1894, relapses occurred in 46 instances—11.3 per cent.—and more than one relapse in two instances. The general statistics of the bath-treatment show a higher proportion of relapses than those of other methods. It

*Table showing the immediate effect of Cold Baths upon the temperature during a period of six days, and the immediate effect of Cold Packs during a subsequent period of six days, in a severe case of Enteric Fever.*

| Baths. Duration, fifteen minutes. | | | | Packs. Duration, usually one hour. | | | |
|---|---|---|---|---|---|---|---|
| Date. | Bath-number. | Temperature. (Before.) Fahr. Cent. | (After.) Fahr. Cent. | Date. | Pack-number. | Temperature. (Before.) Fahr. Cent. | (After.) Fahr. Cent. |
| May 26 | 3 | 106 —41.1 | 102.4—39.1 | June 1 | 1 | 103.6—39.7 | 100.8—38.2 |
| " | 4 | 106.4—41.3 | 99.4—37.4 | " | 2 | 104 —40 | 100.6—38.1 |
| " | 5 | 104.4—40.2 | 101 —38.3 | " | 3 | 103.2—39.5 | 100 —37.8 |
| " | 6 | 105 —40.6 | 102 —38.9 | " | 4 | 103.2—39.5 | 100 —37.8 |
| " | 7 | 104.6—40.3 | 103 —39.4 | " | 5 | 104.6—40.3 | 101 —38.3 |
| " | 8 | 104 —40 | 102.2—39 | " | 6 | 105 —40.6 | 102 —38.9 |
| " | 9 | 105.6—40.9 | 104.2—40.1 | " | 7 | 105.2—40.7 | 102 —38.9 |
| " | 10 | 104.4—40.2 | 101.4—38.5 | " | 8 | 104.6—40.3 | 101.2—38.4 |
| | | | | " | 9 | 104.4—40.2 | 100.8—38.2 |
| May 27 | 11 | 103.8—39.8 | 101 —38.3 | June 2 | 10 | 102.4—39.1 | 100.2—37.9 |
| " | 12 | 103.8—39.8 | 102 —38.9 | " | 11 | 102.6—39.2 | 100 —37.8 |
| " | 13 | 104 —40 | 101 —38.3 | " | 12 | 104 —40 | 102 —38.9 |
| " | 14 | 104 —40 | 101 —38.3 | " | 13 | 105.4—40.8 | 103 —39.4 |
| " | 15 | 105.6—40.9 | 103 —39.4 | " | 14 | 104.6—40.3 | 103.6—39.7 |
| " | 16 | 104.8—40.4 | 103.2—39.5 | " | 15 | 104.6—40.3 | 103.2—39.5 |
| " | 17 | 105.2—40.7 | 102 —38.9 | " | 16 | 104.4—40.2 | 102.4—39.1 |
| May 28 | 18 | 105.6—40.9 | 103.4—39.6 | June 3 | 17 | 104.2—40.1 | 102.8—39.3 |
| " | 19 | 103.8—39.8 | 102 —38.9 | " | 18 | 105.2—40.7 | 103 —39.4 |
| " | 20 | 104.6—40.3 | 100 —37.8 | " | 19 | 103.4—39.6 | 100 —37.8 |
| " | 21 | 102.6 —39.2 | 101.8—38.7 | " | 20 | 103.6—39.7 | 101.2—38.4 |
| " | 22 | 105 —40.6 | 102.6—39.2 | " | 21 | 107.6—42 | 102.6—39.2 |
| " | 23 | 105.6—40.9 | 103 —39.4 | " | 22 | 104.8—40.4 | 102.4—39.1 |
| " | 24 | 105.4—40.8 | 103.2—39.5 | " | 23 | 105.2—40.7 | 103.4—39.6 |
| " | 25 | 105.4—40.8 | 102.8—39.3 | | | | |
| May 29 | 26 | 105.2—40.7 | 103 —39.4 | June 4 | 24 | 104.4—40.2 | 102.4—39.1 |
| " | 27 | 105 —40.6 | 102.4—39.1 | " | 25 | 104.4—40.2 | 100.6—38.1 |
| " | 28 | 104.6—40.3 | 102.4—39.1 | " | 26 | 104.4—40.2 | 101.2—38.4 |
| " | 29 | 102.4—39.1 | 101.4—38.5 | " | 27 | 105 —40.6 | 101.4—38.5 |
| " | 30 | 106 —41.1 | 102 —38.9 | " | 28 | 104.6—40.3 | 102 —38.9 |
| " | 31 | 106 —41.1 | 101 —38.3 | " | 29 | 106 —41.1 | 102.4—39.1 |
| " | 32 | 105.2—40.7 | 100.6—38.1 | " | 30 | 105.6—40.9 | 102.8—39.3 |
| " | 33 | 105.4—40.8 | 102.4—39.1 | " | 31 | 105.2—40.7 | 102.6—39.2 |
| " | 34 | 105.2—40.7 | 101.8—38.7 | | | | |
| May 30 | 35 | 105.2—40.7 | 102.6—39.2 | June 5 | 32 | 104.4—40.2 | 100.6—38.1 |
| " | 36 | 104 —40 | 102 —38.9 | " | 33 | 103 —39.4 | 101.2—38.4 |
| " | 37 | 104.4—40.2 | 103 —39.4 | " | 34 | 103.2—39.5 | 100.6—38.1 |
| " | 38 | 104.2—40.1 | 100 —37.8 | " | 35 | 102.6—39.2 | 99.2—37.3 |
| " | 39 | 103.8—39.8 | 101 —38.3 | " | 36 | 103.2—39.5 | 101.2—38.4 |
| " | 40 | 104.6—40.3 | 100.4—38 | " | 37 | 103.6—39.7 | 101 —38.3 |
| " | 41 | 104.8—40.4 | 101.2—38.4 | " | 38 | 105.2—40.7 | 100.2—37.9 |
| | | | | " | 39 | 105.4—40.8 | 102.6—39.2 |
| May 31 | 42 | 105 —40.6 | 100.6—38.1 | June 6 | 40 | 104.4—40.2 | 101.6—38.6 |
| " | 43 | 103.6—39.7 | 100 —37.8 | " | 41 | 103 —39.4 | 101.2—38.4 |
| " | 44 | 104.6—40.3 | 100 —37.8 | " | 42 | 103 —39.4 | 101 —38.3 |
| " | 45 | 103.6—39.7 | 100.4—38 | " | 43 | 104.6—40.3 | 102 —38.9 |
| " | 46 | 105 —40.6 | 101 —38.3 | " | 44 | 103.6—39.7 | 100.6—38.1 |
| " | 47 | 105.6—40.9 | 101.6—38.6 | " | 45 | 103.8—39.8 | 101.8—38.7 |
| " | 48 | 104.6—40.3 | 101 —38.3 | | | | |
| " | 49 | 103.8—39.8 | 100.4—38 | | | | |

has been suggested that the increased frequency of relapse may be due to the diminished death-rate.

When we apply to the results of the Brand method of treatment the second of our tests, namely, its influence upon the death-rate, its value as compared with other methods becomes at once apparent. As the treatment, systematically carried out, is a routine practice, the statistics of various observers in widely separated countries become available for comparison, and their aggregate is now sufficient to enable us to disregard the variations in the mortality of the disease in different places, seasons, and epidemics. The figures are the more striking and impressive because of their close accord. The minimum

mortality observed by Brand and others in military practice is not obtained in ordinary hospital practice in this country, where patients are not usually received in the earlier days of an acute illness like enteric fever. Thus, the mortality in the Red Cross Hospital at Lyons, according to Tripier and Bouveret, amounted to 7.3 per cent.; that of F. E. Hare in the Brisbane Hospital, Queensland, to 7.84 per cent.; that of Osler in the Johns Hopkins Hospital to 7.1 per cent.; that at the German Hospital, in the services of my colleagues Dr. Trau and Dr. Wolff and in my own service, to 7.8 per cent. These results are most impressive. They show that in the method of Brand, systematically carried out and applied to successive cases as they present themselves, we have the means of saving, out of every hundred cases of the great endemic disease of the present epoch of our civilization, at least seven more lives than by any other plan.

For the purpose of the publication of our work at the German Hospital from time to time I have studied the four hundred and eight cases in six separate series; and as these groups of cases illustrate, among other things, the fact that considerable series of cases may occur without a death, on the one hand, and on the other that, as all practitioners know, fatal cases may follow each other in quick succession, I insert them here.

1. From February 1 to July 15, 1890, 40 cases without a death. Average number of days in hospital, 36.2.[1]

2. From July 15, 1890, to February 1, 1891, 54 cases with 1 death—1.8 per cent. Average number of days in hospital of the non-fatal cases, 38.2.

3. From February 1 to June 1, 1891, 66 cases with 7 deaths—10.6 per cent. Average number of days in hospital of the non-fatal cases, 36.

4. From June 1, 1891, to June 1, 1892, 66 cases with 4 deaths—6 per cent. Average number of days in hospital of the non-fatal cases, 35.[2]

5. From June 1, 1892, to June 1, 1893, 74 cases with 8 deaths—10.8 per cent. Average number of days in hospital of the non-fatal cases, 33.[3]

6. From June 1, 1893, to October 1, 1894, 108 cases with 12 deaths—11.1 per cent. Average number of days in hospital of the non-fatal cases, 38.4.

Total, from February 1, 1890, to October 1, 1894, 408 cases with 32 deaths—7.8 per cent.

Of the cases in Series No. 6 there were—

| | | | | |
|---|---|---|---|---|
| From | 15 to 20 | years of | age | 27 |
| " | 20 " 25 | " | | 40 |
| " | 25 " 30 | " | | 18 |
| " | 30 " 35 | " | | 9 |
| " | 35 " 40 | " | | 10 |
| " | 40 " 45 | " | | 3 |
| " | 45 " 50 | " | | 1 |
| | | | | 108 |

The average number of baths given was 46; the smallest number, 2; the largest number, 168. The average number of days spent in the hospital by non-fatal cases was 38.4.

[1] *The Medical News*, December 6, 1890.

[2] *Ibid.*, Nov. 26, 1892.

[3] *Ibid.*, Nov. 25, 1893.

*Cases of Enteric Fever treated by Systematic Cold Bathing.* Series No. 6, June 1, 1893, to October 1, 1894.*

| | Date of admission. | Sex. | Age. | Day of disease. | Maximum temperature. | 1st day of norm. temp. | Days in house. | No. of baths. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Fahr. Cent. | | | |
| 1 | June 2 | M. | 32 | 10 | 103.6—39.7 | 17 | 31 | 21 |
| 2 | " 19 | F. | 28 | 5 | 104 —40 | 17 | 25 | 29 |
| 3 | " 19 | M. | 24 | 4 | 103.8—39.8 | 13 | 31 | 12 |
| 4 | " 23 | F. | 22 | 6 | 105.4—40.8 | 25 | 50 | 55[1] |
| 5 | July 2 | F. | 22 | 6 | 104.4—40.2 | 15 | 31 | 41 |
| 6 | " 4 | F. | 21 | 11 | 105.8—41 | 20 | 34 | 71 |
| 7 | " 7 | M. | 30 | 15 | 103.2—39.5 | 24 | 25 | 12 |
| 8 | " 11 | M. | 25 | 8 | 104.6—40.3 | 18 | 30 | 63 |
| 9 | " 11 | F. | 42 | 12 | 104.4—40.2 | 21 | 49 | 47 |
| 10 | " 24 | F. | 18 | 3 | 104.6—40.3 | 13 | 28 | 27 |
| 11 | " 24 | F. | 17 | 7 | 104.8—40.4 | 11 | 24 | 19 |
| 12 | " 28 | M. | 24 | 7 | 103 —39.4 | 15 | 18 | 18 |
| 13 | " 29 | M. | 22 | 6 | 104.4—40.2 | 25 | 42 | 99 |
| 14 | " 31 | M. | 20 | 5 | 106 —41.1 | . . | 15 | 113[2] |
| 15 | August 4 | F. | 27 | 4 | 105.2—40.7 | 13 | 68 | 42[3] |
| 16 | " 4 | F. | 21 | 6 | 104.4—40.2 | 18 | 39 | 50 |
| 17 | " 4 | F. | 24 | 17 | 105 —40.6 | 33 | 48 | 90 |
| 18 | " 11 | M. | 28 | 11 | 104.4—40.2 | 19 | 46 | 37[4] |
| 19 | " 12 | M. | 24 | 7 | 105.8—41 | 22 | 54 | 167[5] |
| 20 | " 15 | M. | 23 | 4 | 104.4—40.2 | 15 | 34 | 62 |
| 21 | " 15 | M. | 33 | 4 | 104 —40 | 26 | 34 | 82 |
| 22 | " 17 | M. | 19 | 12 | 105.8—41 | 26 | 43 | 79 |
| 23 | " 20 | M. | 39 | 4 | 104.4—40.2 | 18 | 68 | 11 |
| 24 | " 21 | M. | 19 | 10 | 105 —40.6 | 22 | 32 | 47 |
| 25 | " 24 | M. | 21 | 7 | 104.4—40.2 | 16 | 33 | 51 |
| 26 | " 24 | M. | 24 | 6 | 103.6—39.7 | 14 | 36 | 13[6] |
| 27 | " 26 | F. | 38 | 8 | 104 —40 | 20 | 26 | 14 |
| 28 | " 26 | F. | 23 | . . | 103.4—39.6 | . . | 40 | 17[7] |
| 29 | " 28 | F. | 42 | 9 | 104.8—40.4 | 27 | 63 | 29[8] |
| 30 | " 28 | M. | 28 | 8 | 103.2—39.5 | 14 | 31 | 17 |
| 31 | September 3 | M. | 24 | 14 | 104.2—40.1 | 31 | 34 | 44 |
| 32 | " 6 | F. | 22 | 9 | 104.6—40.3 | 19 | 33 | 21 |
| 33 | " 13 | M. | 32 | 28 | 103.2—39.5 | 39 | 40 | 8 |
| 34 | " 20 | M. | 19 | 4 | 103.8—39.8 | 14 | 55 | 23 |
| 35 | " 21 | F. | 19 | 9 | 104.4—40.2 | 21 | 28 | 37 |
| 36 | " 28 | M. | 18 | 6 | 104.4—40.2 | 25 | 44 | 78 |
| 37 | October 1 | F. | 24 | 6 | 104.6—40.3 | 15 | 27 | 17 |
| 38 | " 7 | M. | 24 | 7 | 104 —40 | 24 | 102 | 47[9] |
| 39 | " 11 | F. | 21 | 11 | 105.8—41 | 26 | 41 | 124[10] |
| 40 | " 12 | M. | 35 | 9 | 103 —39.4 | 14 | 40 | 3 |
| 41 | " 18 | M. | 24 | 12 | 105 —40.6 | 25 | 55 | 41 |
| 42 | " 20 | M. | 19 | 5 | 104.2—40.1 | 20 | 41 | 23 |
| 43 | " 25 | F. | 32 | 28 | 107.6—42 | 42 | 17 | 152[11] |
| 44 | November 4 | F. | 29 | 10 | 105.2—40.7 | 22 | 82 | 24 |
| 45 | " 5 | M. | 28 | 5 | 104.2—40.1 | 21 | 53 | 55 |
| 46 | " 8 | F. | 17 | 8 | 103.6—39.7 | 18 | 40 | 11 |
| 47 | " 12 | F. | 23 | 7 | 106.4—41.3 | . . | 13 | 54 |
| 48 | " 26 | F. | 18 | 5 | 107 —41.7 | . . | 36 | 142[12] |
| 49 | December 1 | F. | 23 | 10 | 105.8—41 | 20 | 54 | 132 |
| 50 | " 6 | F. | 21 | 20 | 103.8—39.8 | 27 | 31 | 13 |
| 51 | " 8 | M. | 29 | 21 | 106 —41.1 | . . | 18 | 42[13] |
| 52 | " 9 | M. | 22 | 8 | 104.6—40.3 | 22 | 52 | 15 |
| 53 | " 9 | M. | 25 | 14 | 103.8—39.8 | 21 | 30 | 15 |

* Compiled from the bedside-notes by Dr. Rockafellow, resident physician. The records of the hospital during this period contain brief notes of a male patient aged forty-five, admitted as a case of alcoholism. Death occurred on the second day, and the lesions of enteric fever were found. The anatomic diagnosis was recorded in accordance with the facts revealed by the autopsy. No bath was given, and the case is not, of course, included in the series.

[1] One relapse.
[2] Lobar pneumonia and death.
[3] Abortion with twins.
[4] One relapse.
[5] One relapse.
[6] One relapse.
[7] Pleural effusion.
[8] One relapse and fecal impaction.
[9] One relapse and phlebitis.
[10] One relapse.
[11] Broncho-pneumonia, phlebitis, and death.
[12] Pneumonia, general furunculosis, and death.
[13] Death.

| | Date of admission. | Sex. | Age. | Day of disease. | Maximum temperature. | 1st day of norm. temp. | Days in house. | No. of baths. |
|---|---|---|---|---|---|---|---|---|
| | | | | | Fahr. Cent. | | | |
| 54 | December 17 . . . | M. | 30 | 11 | 103.8—39.8 | 15 | 27 | 7 |
| 55 | " 19 . . . | M. | 36 | 9 | 104.6—40.3 | 14 | 24 | 15 |
| 56 | " 22 . . . | M. | 27 | 8 | 105.4—40.8 | 24 | 47 | 86[1] |
| 57 | " 28 . . . | F. | 20 | 8 | 104.2—40.1 | 26 | 81 | 22[2] |
| 58 | " 29 . . . | M. | 19 | 9 | 105 —40.6 | 28 | 44 | 67 |
| 59 | " 29 . . . | F. | 22 | 14 | 105.6—40.9 | 25 | 55 | 66 |
| 60 | January 17 . . . | M. | 31 | 14 | 103.8—39.8 | 21 | 37 | 41 |
| 61 | " 17 . . . | M. | 32 | 12 | 104.2—40.1 | 28 | 37 | 21 |
| 62 | February 3 . . . | F. | 16 | 16 | 104 —40 | 23 | 54 | 11 |
| 63 | " 14 . . . | M. | 37 | 22 | 104.2—40.1 | 37 | 37 | 23 |
| 64 | March 1 . . . . | F. | 21 | . . | 105 —40.6 | . . | 19 | 8[3] |
| 65 | " 2 . . . . | M. | 37 | 22 | 103.8—39.8 | 27 | 16 | 12 |
| 66 | " 2 . . . . | M. | 45 | 1 | 105.6—40.9 | . . | 38 | 43[4] |
| 67 | " 12 . . . . | M. | 18 | 4 | 104 —40 | 15 | 26 | 20 |
| 68 | " 16 . . . . | M. | 18 | 8 | 105.4—40.8 | 16 | 22 | 18 |
| 69 | " 18 . . . . | F. | 25 | . . | 103 —39.4 | . . | 57 | 15 |
| 70 | " 26 . . . . | M. | 25 | 26 | 105 —40.6 | 43 | 46 | 45 |
| 71 | April 5 . . . . | F. | 22 | 15 | 105.8—41 | 35 | 45 | 51[5] |
| 72 | " 7 . . . . | M. | 19 | 8 | 105.4—40.8 | 29 | 48 | 135 |
| 73 | " 21 . . . . | M. | 17 | 5 | 105.2—40.7 | 23 | 74 | 106[6] |
| 74 | " 23 . . . . | M. | 29 | 6 | 104 —40 | 19 | 23 | 10 |
| 75 | May 5 . . . . . | M. | 29 | 16 | 102.6—39.2 | 21 | 23 | 10 |
| 76 | " 9 . . . . . | M. | 19 | 21 | 104 —40 | 22 | 22 | 17[7] |
| 77 | " 14 . . . . . | M. | 28 | 5 | 105.4—40.8 | 22 | 58 | 106 |
| 78 | " 24 . . . . . | M. | 23 | . . | 102.2—39 | . . | 20 | 2[8] |
| 79 | " 31 . . . . . | F. | 21 | . . | 104.8—40.4 | . . | 30 | 31 |
| 80 | June 10 . . . . . | M. | 18 | . . | 105.4—40.8 | . . | 50 | 69[9] |
| 81 | " 22 . . . . . | M. | 20 | . . | 103.8—39.8 | . . | 22 | 13 |
| 82 | " 23 . . . . . | M. | 23 | . . | 103 —39.4 | . . | 21 | 20 |
| 83 | July 3 . . . . . | M. | 33 | . . | 104.4—40.2 | . . | 34 | 49 |
| 84 | " 3 . . . . . | M. | 23 | . . | 104.8—40.4 | . . | 23 | 38 |
| 85 | " 5 . . . . . | M. | 28 | . . | 104.2—40.1 | . . | 33 | 22[10] |
| 86 | " 18 . . . . . | M. | 22 | 4 | 106 —41.1 | 15 | 39 | 76 |
| 87 | " 21 . . . . . | F. | 17 | . . | 104 —40 | . . | 13 | 60[11] |
| 88 | " 23 . . . . . | F. | 36 | . . | 106 —41.1 | . . | 27 | 168[12] |
| 89 | " 24 . . . . . | M. | 18 | . . | 104.6—40.3 | . . | 44 | 70 |
| 90 | " 27 . . . . . | F. | 28 | 7 | 104 —40 | 18 | 51 | 62 |
| 91 | " 28 . . . . . | M. | 19 | 7 | 104.4—40.2 | 23 | 30 | 77 |
| 92 | August 1 . . . . | F. | 22 | . . | 105.4—40.8 | . . | 54 | 99[13] |
| 93 | " 4 . . . . | M. | 37 | . . | 103.2—39.5 | . . | 12 | 10[14] |
| 94 | " 7 . . . . | M. | 16 | . . | 104.2—40.1 | . . | 15 | 6 |
| 95 | " 11 . . . . | M. | 46 | . . | 104.4—40.2 | . . | 23 | 59[15] |
| 96 | " 16 . . . . | M. | 39 | . . | 104.8—40.4 | . . | 26 | 33 |
| 97 | " 20 . . . . | M. | 22 | 8 | 105.2—40.7 | 24 | 28 | 68 |
| 98 | " 26 . . . . | M. | 26 | 10 | 105.2—40.7 | 62 | 42 | 119[16] |
| 99 | " 31 . . . . | F. | 40 | 7 | 104 —40 | 19 | 31 | 8 |
| 100 | September 1 . . | M. | 40 | 6 | 103.4—39.6 | 20 | 43 | 11[17] |
| 101 | " 3 . . | F. | 25 | 13 | 104.2—40.1 | 20 | 20 | 4 |
| 102 | " 8 . . | M. | 20 | . . | 102.4—39.1 | . . | 26 | 4 |
| 103 | " 15 . . | M. | 26 | . . | 104.6—40.3 | . . | 13 | 46 |
| 104 | " 17 . . | M. | 34 | 16 | 104.2—40.1 | 31 | 52 | 41[18] |
| 105 | " 20 . . | F. | 26 | 6 | 105 —40.6 | 38 | 58 | 127 |
| 106 | " 24 . . | M. | 23 | 22 | 103.4—39.6 | 30 | 52 | 16[19] |
| 107 | " 27 . . | M. | 20 | 20 | 103.6—39.7 | 30 | 50 | 29[20] |
| 108 | " 28 . . | M. | 27 | . . | 104.4—40.2 | . . | 16 | 66[21] |

Total number of cases, 108; deaths, 12; mortality, 11.1 per cent.; relapses, 17—15.57 per cent.

[1] One relapse.
[2] Pneumonia and endocarditis.
[3] One relapse, acute nephritis, and death.
[4] Death.
[5] One relapse and pneumonia.
[6] Pneumonia and peritonitis.
[7] One relapse.
[8] Admitted during last stage.
[9] One relapse.
[10] One relapse.
[11] Death.
[12] One relapse and death.
[13] One relapse.
[14] Death.
[15] Death.
[16] One relapse and death.
[17] Complicated with malaria.
[18] Phlebitis.
[19] One relapse.
[20] One relapse.
[21] Pneumonia and death.

NOTES ON THE FATAL CASES.—No. 14.—C. S., a male, twenty years of age, was admitted on the fifth day of the disease; pneumonia developed on the sixteenth day, and death occurred on the twentieth day.

No. 43.—Mrs. F., thirty-two years of age, was admitted on the twenty-eighth day of the disease; pneumonia developed on the fortieth day, acute nephritis on the forty-second day, death following two days later. The maximum temperature, 107.6° F. (42° C.), was observed on the afternoon of death.

No. 48.—A. G., a female, eighteen years of age, was admitted on the fifth day of the disease; intestinal hemorrhage took place on the eleventh day, pneumonia following on the thirteenth day; general furunculosis developed, the patient dying on the thirty-ninth day, with a temperature of 107° F. (41.7° C.) and a pulse of 160.

No. 51.—F. F., a female, twenty-nine years of age, was admitted on the twenty-first day of the disease in a very weak condition, a "walking case;" death took place from pneumonia on the thirty-ninth day, with a pulse of 168.

No. 64.—K. S., a female, twenty-one years of age; thirteen days after admission suffered an attack of acute nephritis, death occurring on the seventeenth day.

No. 66.—G. D., a male, forty-five years of age, was admitted on the first day of the disease; death took place from meningitis on the thirty-eighth day.

No. 87.—M. W., a female, seventeen years of age, was admitted late in the disease; death took place two weeks after admission from exhaustion.

No. 88.—L. R., a female, thirty-six years of age, was admitted on the fifth day of the disease; a relapse occurred during the third week, death following during the fifth week from exhaustion.

No. 93.—W. T., a male, thirty-seven years of age, was admitted during the third week of the disease; death occurred very suddenly during the fifth week. Previous to death the temperature was normal for five days. The post-mortem examination revealed a clot in the pulmonary artery.

No. 95.—J. S., a male, forty-six years of age, was delirious from the time of admission; intestinal hemorrhages took place during the second week. Diffuse broncho-pneumonia developed early in the disease, which caused death at the beginning of the fourth week.

No. 98.—A. S., a male, twenty-six years of age, was admitted on the tenth day of the disease; he was very nervous from the outset, and died on the forty-first day.

No. 108.—A. G., a male, twenty-seven years of age, was admitted early in the disease. Profuse hemorrhage occurred during the third week, followed by death.

The fatal cases have, as a rule, been grave from the beginning, though very often death has not occurred until after prolonged illness. In some of them the evidences of an intense local or systemic infection, such as intestinal hemorrhage and very high temperature, have been present; in others grave complications, such as pneumonia, acute nephritis and cerebral meningitis, have occurred; while finally, a small proportion have succumbed to a relapse. Thus in the 24 fatal cases in Series 4, 5 and 6, intestinal hemorrhage occurred in six; very high temperatures in seven—108.4° F. (42.4° C.), 106° F. (41.1° C.), 106.4° F. (41.3° C.), 107.6° F. (42° C.), 107° F. (41.7° C.), 106° (41.1° C.) and 105° F. (40.6° C.) respectively; croupous pneumonia in seven; severe broncho-pneumonia, determining the fatal issue, in one; symptoms of meningitis in three; acute nephritis in two; relapse in three. In one instance it is noted that the patient had great mental depression from the outset, and in another that the patient was very nervous from the beginning of the attack, and in a third instance the patient was admitted toward the end of the second week with a pulse of 172 and a temperature of 106° F. (41.1° C.). This patient received three baths only and died twenty-one days after admission. In one instance the patient

was admitted toward the end of the third week; ten baths only were administered; the temperature fell to normal on the seventh day; five days later death occurred suddenly in consequence of thrombosis of the pulmonary artery.

A good deal has been said concerning the harshness of the Brand method of treating enteric fever, even by those who, like Osler, have written most convincingly in its favor. Others have not hesitated to speak of it as "brutal" and "barbarous." Such terms as the latter can only have been employed by those who have had no practical knowledge of the method. Our experience at the German Hospital does not justify these criticisms. Not infrequently the patients complain of the disagreeable sensations attending the earlier baths. After a day or two, however, they become accustomed to them, and it has happened in more than one instance that a patient has stepped into the tub at his bedside without waiting for the nurse. Occasionally the patients have complained of the baths throughout the whole treatment, but in only one instance, so far as I know, has the patient, after a few days' trial, absolutely declined the treatment. In private practice the difficulty in overcoming the objections of the patient has sometimes been exceedingly great. The baths not only involve much discomfort and occasionally some suffering on the part of the patient, but they also entail upon the nurses and attendants a large amount of work, particularly in a hospital service where there are at times a large number of cases under treatment. These facts constitute hardships that cannot be disregarded, but as objections to the employment of a method of treating enteric fever that enormously diminishes the sufferings of the individual attack and reduces the general mortality at least one-half, they are entirely without weight.

No theory of the action of the cold bath has been yet adduced which is entirely satisfactory. The more obvious effects of the individual bath are seen in its action upon the heart and vascular system and upon the nervous system. The bath is powerfully antipyretic, but its influence in this respect must be regarded, in part at least, as secondary. Its chief action is exerted upon the nervous system, which it affects in such a manner as to increase its resistance to the toxic principles of the disease. This is doubtless accomplished by the action of cold water upon the peripheral nerve-endings, a stimulus being transmitted to the nerve-centers presiding over the functions of circulation, respiration, digestion, nutrition, and excretion. It is probable that the flux and reflux of the blood between the periphery and the viscera constitute an important factor in the therapeutic process; nor can we disregard in this connection the rhythmic disturbance and stimulus of the bath rigorously repeated at intervals of three hours—a point upon which Brand earnestly insists. The degree of importance to be attributed to the leukocytosis observed after the bath cannot yet be determined. The general reinforcement of function is shown by improved action of the heart, the first sound continuing distinct, the pulse being slower and more regular, the tension of the arteries better and dicrotism absent; it is shown also by persistence of appetite and digestive power, per-

mitting free alimentation without gastric derangement, by the maintenance of the secretions, by the deepening and slowing of the respiration, by the absence of serious nervous symptoms, save in the graver cases, and finally by the diminished tendency to complications and the more rapid convalescence.

4. *Prophylactic and Curative Inoculation.*—The results accomplished by immunizing and curative inoculations in hydrophobia, tuberculosis, and tetanus, the very suggestive though not generally accepted action of similar methods in pneumonia and cholera, and, above all, the definite and highly successful effects obtained from the use of antitoxic serum in diphtheria, have naturally led to a search for similar antitoxic principles in enteric fever.

The investigations of Stern, Brieger, Kitasato and Wassermann (1892) led Fraenkel and Manchot to employ a sterilized liquid obtained from the culture of typhoid-bacilli in bouillon made from the thymus of the calf and heated to 60° C. Their report is based upon the treatment of fifty-seven cases. The injections were made deeply into the muscles of the buttock, and in no instance did unfavorable local effects follow. The first injection consisted of 0.5 c.cm. of the sterilized fluid—a dose not followed by reaction even in the case of children. On the following day 1 c.cm. was injected into the opposite buttock. In the majority of cases the second injection was followed by elevation of temperature, with chilly sensations. In the course of some hours, however, the temperature usually showed a decided fall, but rose again in those cases in which the injections were discontinued. Fraenkel gave an injection every other day, increasing the dose about 1 c.cm. each day. The fever ceased to be continuous and the chart showed marked remissions. The constitutional symptoms were much less intense, and complete absence of fever followed in the course of a few days. The early defervescence was followed by diuresis, with cessation of diarrhea. The spleen, however, remained enlarged and the rose-spots persisted.

Rumpf about the same time published reports of the results of the treatment of thirty cases of enteric fever with sterilized cultures of the bacillus pyocyaneus. The pyocyaneus-bouillon was obtained by the culture of the bacillus pyocyaneus in thymus-bouillon. Its action was very much like that observed in the cases treated by Fraenkel with typhoid-bouillon. The temperature-curve shortly assumed a remittent type; there was increased action of the kidneys and rapid subsidence of nervous symptoms.

Hammerschlag has reported five cases of enteric fever treated by the transfusion of blood from convalescent cases. The results, however, are inconclusive. Hughes and Carter treated several cases with blood-serum obtained from convalescents. In some instances the injections were followed by a decided fall of temperature. Otherwise there was no important modification of the symptoms.

Quite recently Klemperer and Levy, by treating dogs with gradually increasing amounts of bouillon-cultures of typhoid-bacilli, obtained a blood-serum capable of immunizing susceptible animals, such as mice and guinea-pigs, against the action of virulent typhoid-bacilli, and of effecting a cure by

this treatment some time after infection had been produced. Careful experimentation established the fact that the administration of the serum in small quantities to human beings was without danger. The treatment was instituted in five patients suffering from enteric fever. Three injections were administered on successive evenings. They were followed by no local discomfort or constitutional disturbance. In particular, cutaneous rashes and albuminuria were not observed. The patients were selected cases in the first week of the disease. All pursued a mild course.

# TYPHUS FEVER.

By J. C. WILSON.

An efficient prophylaxis against the development of typhus fever must rest upon a general observance of public and personal hygiene; against its spread from a center of infection, upon a rigid quarantine. The appearance of this disease in well-regulated, civilized communities where sanitary laws are observed no longer occasions more than passing alarm, as it has been found that under such circumstances it does not tend to become epidemic. Kelsch has divided the historic course of typhus into three periods: A first, ancient and obscure, during which such records as exist show the uncertainty and confusion relating to the earlier descriptions of the pestilential fevers. This period ends at the commencement of the sixteenth century. A second period extends from the year 1501 to 1815. The first satisfactory description of typhus dates from the beginning of this period, when, according to Fracastorius, it spread from Cyprus into Italy as a disease previously unknown to the physicians of the latter country. By the middle of that century it had become, in connection with the plague, the predominant form of epidemic disease in Central Europe. The movements of armies and military enterprises contributed greatly to its development and extension, but during that and the following two centuries typhus constituted the great fever in every country of Europe and in all states of society. Murchison has well said that "A complete history of typhus would be the history of Europe for the last three and a half centuries."

A third period, beginning with 1815, includes the greater part of the present century. During this time typhus has progressively disappeared from the regions in which it formerly prevailed, until it has ceased to recur as an epidemic disease save in certain limited districts. Among these are some parts of Southeastern Europe and Algiers. Quite recently limited outbreaks of typhus in various parts of France have attracted attention. Ireland is now less conspicuous as a hotbed for the growth and dissemination of this fever than in former years. Kelsch and other recent writers have confirmed the view that the danger of outbreaks of typhus in any locality is proportionate to the degree in which ordinary sanitary laws are disregarded. It is to be noted that filth, poverty, and over-crowding are predisposing and not exciting causes of typhus. The difficulty in tracing the source of the contagion in limited local outbreaks has led to the view that the disease may arise *de novo*. The clinical history of the disease, and the fact that it is self-limited, self-protective, and highly contagious, indicate that the exciting cause is a living prin-

ciple. Such being the case, the hypothesis of a spontaneous, independent origin of the disease is untenable.

Again, it has been suggested that the infecting principle, whether it be a bacterium or some other microbe, is of wide distribution, and under ordinary circumstances incapable of producing the disease; but that under conditions of filth, ill-ventilation, over-crowding and the accumulation of human excreta, it may acquire intense pathogenic properties and give rise to typhus-epidemics.

Typhus fever has occasionally occurred in the United States and British North America in restricted epidemics. It is probable that the greater number of the epidemics that prevailed extensively in the United States in the early part of the present century, and have been described by the medical writers of the period as "spotted fever," "petechial typhus" and "typhus syncopalis," were outbreaks of cerebro-spinal fever. More recently typhus fever has made its appearance in the cities of the seaboard as a direct importation from Ireland, Southeastern Russia and other transatlantic countries in which it has prevailed. Hence the popular terms "Irish fever," "emigrant-fever," and "ship-fever." The first cases usually show themselves in almshouses, public dormitories, or brothels. In thirteen years during which I served as attending physician to the Philadelphia Hospital, two limited outbreaks of typhus occurred in that institution. In both instances the first cases were brought from crowded slums in the heart of the city, beyond which the contagion could not be traced. Hirsch has pointed out the fact that the outbreaks of typhus in the United States have occurred in or near seaboard cities in direct communication with those parts of the world in which the disease makes its home, and that they have occurred in localities in which the predisposing causes of typhus fever existed to a high degree. The inability to trace the contagion in any outbreak is not a sufficient warrant for the supposition that it has arisen spontaneously.

The exciting cause of typhus has not yet been discovered. In this respect the disease under consideration resembles measles, scarlatina, and certain other infections, the causes of which have thus far eluded investigation, though we are forced by analogy to ascribe them to *contagia viva*.

Hlava discovered a streptococcus which he believed to be peculiar to typhus. It was not, however, constantly present, and subsequent investigators have not regarded it as specific. The investigations of Thoinot and others have shown that the blood of typhus-patients does not communicate the disease to animals upon inoculation. Lewaschew has quite recently described a micrococcus, found in blood taken from the spleen and the tip of the finger, which he has called micrococcus exanthematicus, believing it to be the agent of infection. The same bacterium was found in the contents of the conjunctival sac. It shows characteristic cultures on agar-agar. The conclusion that in this micro-organism we have the pathogenic factor of typhus has not been confirmed.

The prevalence of typhus is but little influenced by the time of the year. Epidemics arise and pursue their course irrespective of the seasons. It has occasionally been observed that in prolonged epidemics the number of cases has diminished during the summer and again increased in the late autumn and

early winter. This diminution, however, has not begun at once upon the advent of warm weather, nor has the increase followed immediately upon cold. As, then, a continuation of these conditions is necessary to exert their respective influence upon epidemics, it would appear that the variation in the prevalence of typhus in the winter and spring months is due, not to the weather but to the prolonged over-crowding and deficient ventilation of the dwellings of the poor in winter. Meteorologic conditions exert little or no influence upon typhus.

With reference to the individual, age confers no immunity from an attack of typhus. Death-registers and hospital-reports indicate that the disease is chiefly one of adult life. The evidence furnished by data of this kind is untrustworthy. Children contribute, for obvious reasons, a relatively smaller number of cases to hospital-statistics than adults, and for the reason that the disease is much less fatal in the early years of life they contribute an actually smaller number to mortality-statistics. It is also to be noted that, owing to the immunity acquired by a previous attack, many adults escape the disease upon exposure. Of 3456 cases admitted to the London Fever Hospital during ten years, from 1848 to 1857, the mean age was 29.33 years, and of 18,138 cases admitted in twenty-three years, from 1848 to 1870, more than one-half (9248) occurred between the ages of 10 and 30. The youngest patient was one month of age, the oldest eighty-four years.

Sex is without influence. Up to thirty years of age slightly more males than females contract typhus; above the age of thirty the reverse is true. Taking all ages together, the proportion of cases is about the same for each sex.

Occupation, except as it involves actual exposure to the contagion, as in the case of hospital attendants, physicians, and clergymen, does not predispose to typhus. Patients admitted to hospitals suffering with this fever are usually in destitute circumstances. Seamen upon sprees, the poorer class of emigrants, wandering musicians, tramps, and beggars are usually the first to suffer in an outbreak. Chronic alcoholism and alcoholic excesses predispose to typhus. Murchison makes the remarkable statement that a single intoxication may render the subject liable to the disease, and that he has "known several instances of persons exposed for months to the poison in the most concentrated form who were not attacked until immediately after a debauch."

The condition of convalescence from acute illness seems to be attended with special liability. It frequently happens during epidemics that persons who have long escaped the fever are seized with it after an attack of illness that may have been slight. In the Crimean war scurvy was found to be a powerful predisposing cause.

Bodily and mental fatigue, anxiety, and other depressing emotions, particularly a dread of contracting the disease, have been thought to increase the liability. It is probable that the importance of these influences has been overestimated. In typhus, as in other infectious diseases, personal idiosyncrasy plays an important part. Different individuals possess for typhus, as for other

contagious diseases, a varying degree of susceptibility upon exposure, independently of other elements of predisposition.

The mode of life of the individual plays a very important part in predisposing to the disease. Typhus is a disease of the poor and under-fed in large cities. Under the ordinary circumstances of its endemic or mildly epidemic prevalence it is restricted to the indigent classes of the community and those just above them in social rank. Persons of the better classes contract the disease only upon direct exposure. It is only under unusual circumstances or in fierce epidemics that any considerable portion of the well-to-do are attacked.

Typhus is highly contagious. Its prevalence in restricted localities is proportionate to the degree of intercourse between the healthy and the sick. When it breaks out in a house, those living in the same room with the person first attacked are usually next in order to develop the disease. In hospitals, the resident physicians, nurses, and orderlies, who are almost continuously exposed, are much more commonly attacked than students and attending physicians who visit the wards. Very often in general hospitals the admission of a single case of typhus is followed by the spread of the disease among the attendants and other patients. The prompt removal of the first cases from the house or locality in which typhus has made its appearance usually results in stamping out the disease, while the neglect of this measure has led to the establishment of a focus of contagion. Actual contact is the most common method of communication. The infecting principle is borne in the expired air of patients as well as in the exhalations from their skin.

The distance to which the disease may be conveyed through the atmosphere is not great. If the room occupied by the patient be spacious, airy, and clean, and contact with the patient and his belongings be avoided, the risk of contagion is reduced to a minimum. Physicians who visit patients in such apartments with due precaution and pass at once into the open air incur but little risk of contracting the disease; those, on the other hand, who heedlessly inhale the atmosphere immediately surrounding the patient or incautiously approach him or tarry in his presence, expose themselves to great danger of infection, especially if the apartment be small and ill ventilated.

Typhus is never communicated by means of the atmosphere from fever-hospitals to dwellings in their vicinity.

Articles of all kinds with which the patient has come in contact may constitute fomites. This is particularly true of his bedding and clothing. The infection persists also in the apartment. Particular houses thus become hot-beds for the production of the disease; ships in which typhus-patients have been transported become infected; and vehicles used to convey patients to the hospital may communicate the sickness to their next occupants. Those who wash the undisinfected clothing of typhus-patients are peculiarly liable to contract the disease. Woollen substances are more likely to absorb and retain the contagium, and garments of a dark than those of a light hue. It follows that the contagium of typhus, as that of certain other infectious diseases, particu-

larly scarlet fever, may be conveyed from the sick or from infected localities to a distance by individuals not themselves suffering from the fever. It is evident that the contagium, in order to be conveyed by means of fomites, must be concentrated, and that habits of caution and cleanliness, together with free ventilation, reduce this danger to a minimum. There are no facts to prove that the disease is disseminated by means of the discharges from the bowels, as is the case with enteric fever. Typhus fever may be contracted by susceptible persons through contact with the bodies of those who have died of it.

Some difference of opinion exists as to the period of greatest contagiousness. It was formerly thought that typhus was but slightly contagious during the first week, the period in which it was most likely to be communicated being from the appearance of the eruption to the end of the attack. Recent observers, however, incline to the view that the disease is contagious throughout the whole course of the attack. After the disappearance of the fever and the return of appetite and digestion, the danger of contagion rapidly diminishes. It is to be borne in mind, however, that the clothing of the patient and articles in the sick-room may, not only at this period but for a long time afterward, unless disinfected and exposed to the air, transmit the specific cause of the disease. Immunity from a second attack is enjoyed by a majority of those who have suffered from typhus fever.

The period of incubation is variable. Murchison places it at twelve days or less, rarely longer; Lebert at from five to seven days. Recently Henry Hoel found it to be, as nearly as could be determined, from twelve to thirteen days. It is rarely longer than this, though occasional cases have developed as late as the eighteenth day after exposure. There are no reliable data in support of the statement that it sometimes exceeds three weeks. Cases have been recorded in which the symptoms of the disease have shown themselves immediately after exposure. In these instances the possibility of previous unsuspected exposure is to be considered.

The foregoing facts form the basis of a practical prophylaxis.

Typhus is no longer popularly known as "ship-fever" or "jail-fever," for public opinion and legal enactments have forced the observation of decent sanitary regulations where large numbers of ignorant and destitute individuals are crowded together in confinement. Improvement in the sanitary condition of localities formerly infested with typhus fever has led to its disappearance as an endemic disease, while the great epidemics of typhus have become, even in the wars of recent times, almost unknown.

Upon the outbreak of an epidemic the first cases should be removed to special hospitals for infectious diseases; or in default of these they should be isolated in tents. Patients suspected of having typhus should not be admitted into the wards of general hospitals. The infected rooms and houses must be thoroughly disinfected, cleansed, and ventilated, and general sanitary measures to obviate the predisposing causes of the fever in the locality should be strenuously carried out. The clothes and belongings of the patient should likewise be disinfected by prolonged exposure to heat, to the fumes of burning sulphur in the

presence of water, or by boiling. The infected bedding should be subjected to the same treatment, and the materials used for filling mattresses and pillows should be burned.

The ward or apartment occupied by typhus-patients must be quarantined. The attendants must be allowed opportunities for proper rest and exercise in the open air; they must be informed of the importance of thorough ventilation in diminishing the danger of contagion, and arrangements are to be made by which, for the time being, they can avoid contact with individuals susceptible to the disease. Scrupulous cleanliness, the immediate disinfection of all clothing, and adequate ventilation are of imperative importance. When, as sometimes happens in epidemics, it becomes necessary to treat patients in their homes, all unnecessary furniture, bed-curtains, and hangings are to be removed from the room. Quiet is to be observed and all visitors are to be excluded.

The patient's strength should be husbanded from the beginning of the attack. All mental and bodily effort is to be avoided. It is a matter of common observation that those who struggle against the disease at its onset usually suffer from great prostration later. The patient should therefore betake himself to his bed upon the first appearance of the symptoms; nor should he leave it for any purpose until the close of the attack. In the graver cases it is imperative that the patient should not assume the upright or even the sitting posture, as fatal syncope may result. It is therefore necessary in such cases to use the urinal and the bed-pan.

The general management of typhus is the same as that of enteric fever, due attention being paid to the early and grave adynamia. Nourishment should be given in moderate amounts at intervals of two hours during the day and three during the night. If the patient be asleep at the time food is due he should not be disturbed. In the course of an hour he should be aroused and a slightly increased amount of nourishment at once administered. Thirst should be satisfied with water in abundance. Occasionally weak lemonade or effervescing water may be given. The diet should consist of milk, broths, or light soups. The milk may be administered warm, cold, peptonized, or with the occasional addition of coffee, whisky, or brandy, according to the requirements of individual cases. When there is a tendency to stupor it is of great importance that, in order to avoid deglutition-pneumonia, the patient should be aroused before the administration of food by the mouth. Under such circumstances rectal alimentation, and especially the administration of strong coffee by enema, may become necessary.

Alcohol is indicated in a large proportion of the cases by the early prostration and cardiac asthenia. It is, however, not required in every case. The greater number of children and many adults may be satisfactorily treated without it. The general rules for its administration are the same in typhus as in enteric fever, the first sound of the heart, the character of the pulse, and the phenomena relating to the nervous system constituting the indications for its administration. Ataxic symptoms, delirium, and a tendency to coma are to be treated by the free administration of alcoholic stimulants. No definite rules

can be laid down as to the quantity to be administered. It varies from an ounce or two of spirit given in tablespoonful-doses as the symptoms demand, to twelve or fourteen ounces distributed throughout the twenty-four hours at regular intervals. Sound whisky and brandy are the most satisfactory forms in which alcohol can be given. English physicians recommend the malt liquors in typhus, and state that they are agreeable to many patients. Under circumstances that permit its use, champagne may be given. When the prostration is extreme and the patient is unable to swallow, alcohol or ether may be given by hypodermic injection. Among the diffusible stimulants useful in typhus are ammonium carbonate, chloroform, camphor, and turpentine.

No drug or course of medication has the power either to arrest the disease or to shorten the course of the attack. The sufferings of the patient may be mitigated and complications to some extent warded off, or, when they arise, controlled, by watchful attention and judicious therapy. More than this the resources of medicine at the present time do not lead us to expect.

In general the treatment is expectant-symptomatic. The headache may be treated by applications of cold to the head; if intense it may be relieved by small doses of morphin and atropin, either by the mouth or by hypodermic injection; or opium may be administered by the rectum; if the headache is agonizing, two or three leeches may be applied at the edges of the hair on each temple. A tendency to coma must be regarded as a contraindication to the use of opiates. Sleeplessness, nervous excitement, and delirium may, to some extent, be alleviated by the management of the sick-room and the personal ministrations of the nurse. These symptoms call for the use of chloral, opium, and its derivatives, especially in combination with minute doses of belladonna or atropin. If there be great restlessness and jactitation, hyoscin hydrobromate, alone or in combination with morphin sulphate, should be administered hypodermically. It is necessary to call attention to the danger of chloral in large or frequently repeated doses when there is marked cardiac asthenia. Protracted sleeplessness with ataxic phenomena may be treated with camphor, valerian, or asafetida, with morphin and free alcoholic stimulation. Musk is of questionable advantage, and at the present time one would hesitate to follow Graves in the administration of tartar emetic.

Stupor may be treated with small cupfuls of strong coffee repeated at intervals of two or three hours. Cold affusions may become necessary. Stimulating enemata containing turpentine may be administered. They are additionally useful in bringing about action of the bowels.

The administration of the mineral acids has received the sanction of the highest clinical authorities. Nitrohydrochloric acid has been preferred in this country. Da Costa gave it in doses of from 3 to 5 drops, either alone or, when pulmonary complications were present, alternately with turpentine. When pulmonary complications became prominent the acid was discontinued, and turpentine was given in conjunction with quinin and applied externally in stupes to the chest. Dilute phosphoric acid was employed by Lebert.

Gastric irritability and vomiting are to be treated by the administration of

pellets of ice and restricted alimentation. If persistent, all food by the mouth must be temporarily withheld, recourse being had to nutritious enemata.

The constipation, which is so prominent a symptom in typhus fever, should be relieved by the occasional administration of calomel in laxative doses; when it is associated with gastric irritability, calomel may be administered in fractional doses. There are cases in which salines are well borne and have a good effect.

The complications of typhus must be treated in accordance with general therapeutic principles. Suppurative inflammation of the parotid and its overlying tissues, and similar processes elsewhere in the body, are to be treated by the prompt evacuation of the pus and antiseptic dressings.

The febrile movement should be managed upon the same general lines as that of enteric fever. The temptation to use the modern analgesic antipyretics should be shunned, as their administration is attended with danger. Repeated free spongings with cold water, or an occasional pack is of advantage. As already stated, a tendency to stupor, especially if accompanied by high temperature, is to be treated by cold affusions.

Should I again have the opportunity of treating cases in an outbreak of typhus I should unhesitatingly adopt systematic cold bathing according to the method of Brand, as I have employed it in enteric fever. Combemale found that a limited number of cases treated upon the expectant plan yielded a mortality of 35 per cent.; cases with two cold baths a day gave a mortality of 33⅓ per cent.; cases treated with six baths a day gave a mortality of 16.5 per cent.; other cases, treated by large cold-water enemata, six per day, yielded a mortality of 28.6 per cent. He concludes that the more rigidly Brand's method is followed the greater will be the reduction in mortality. His figures, however, are too small to justify conclusions.

Petresco not only regards hydrotherapy as the most effectual treatment of typhus fever, but even considers it the only mode of treatment by which the mortality can be reduced to a minimum. He regards it as especially adapted to the severer adynamic forms of typhus, in which it often produces remarkable results. He regards this method of treatment as unattended with danger and available, notwithstanding complications and localizations of the infection. The cold pack is to be preferred to cold douches or cold baths by reason of its greater simplicity and equally good results.

Convalescence is, as a rule, rapid and steadily progressive, unless retarded by complications. The appetite is often ravenous and must for a few days be controlled. If the patient remain feeble and pale, bark, iron, quinin, and perhaps cod-liver oil should be given. Attention is to be paid to the condition of the heart, which for a time may require strychnin, caffein, or the preparations of kola. Sleeplessness is to be obviated by judiciously chosen hypnotics, or, if circumstances permit, a change of climate to the seashore or an ocean-voyage. The patient must be warned against the risks of too great haste to resume his ordinary occupation.

# RELAPSING FEVER (FEBRIS RECURRENS; SPIRILLUM-FEVER).

By J. C. WILSON.

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The spirocheta of Obermeier is the exciting cause of relapsing fever. The disease is highly contagious; it has been produced in human beings by the inoculation of blood obtained from patients during a paroxysm, and Vandyke Carter in India caused attacks in monkeys by direct inoculation of the blood. Overcrowding, filthy living, and want of food constitute predisposing influences, and general epidemics of the disease have usually affected communities for the time being subject to these conditions. That these predisposing influences are not essential has been shown by the fact that individuals living under the most favorable circumstances have been attacked, and that limited epidemics have prevailed, as was the case in Philadelphia in 1869, among well-to-do people. The life-history of the spirocheta remains involved in obscurity.

**Prophylaxis.**—Upon the appearance of relapsing fever in any community organized efforts must at once be made to relieve the sufferings of the poor and to provide them with a sufficient quantity of wholesome food. Overcrowding must be diminished in districts liable to become pestilential centers. If the drainage be defective, temporary measures must be immediately instituted to get rid of stagnant water; accumulations of filth and garbage must be at once removed. Local boards of health, or, in default of these, temporary organizations of citizens, should insist upon the immediate reporting to a central committee of cases of suspicious illness and of all localities and dwellings found to be in an unsanitary condition. They should also take measures to instruct the public in regard to the precautions to be taken with a view of avoiding the disease. Free ventilation is important. Contagious as relapsing fever is, it rarely spreads when cases occur in large and well-ventilated houses or in the spacious and properly aired wards of well-managed hospitals. Those whose vocations bring them into close contact with the sick are, however, liable to contract the disease. In view of the uncertainty as to the methods by which the infecting organisms find access to the body, all drinking-water and all milk should be boiled. Cleanliness of the abode and person must be insisted upon. The contagious principle is readily transmitted by means of the clothing and bedding of the sick. The soiled bed-clothes and body-linen of the patient should be immediately subjected to prolonged boiling. When the patient is treated in his own house all carpets, hangings, and unnecessary furniture should be removed from the room.

The patient should be isolated. If practicable he should be immediately removed to a special hospital for contagious diseases or to a temporary hospital erected for the purpose. Under these circumstances, or after convalescence when the patient has been treated at home, the apartment should be fumigated by burning sulphur in the presence of moisture. The room should be subsequently thoroughly aired, cleansed, and whitewashed. The mattresses should be disinfected by dry heat or by steam under pressure. Cheaper bedding-materials, as straw, moss, fine shavings, and husks should be burned.

**Treatment.**—No drug or method of treatment has been found to exercise any influence whatever upon the course of the disease. The treatment should be expectant or expectant-symptomatic. It is not in our power either to shorten the paroxysm or to prevent the relapse.

Rest in bed is necessary during the febrile paroxysm, and should be maintained during the intermission. The apartment should be thoroughly ventilated. The diet should consist of milk, broths, meat-jellies, and light farinaceous foods. If there be much gastric disturbance koumiss, kefyr, matzoon, peptonized milk, or albumin-water may be given. During the intermission solid food may in many cases be given, the patient often at this period craving and readily digesting broiled meats, bread, vegetables, and fruits. The patient must not be allowed to suffer from thirst. Pure water, carbonated water, Vichy or seltzer, or milk diluted with any of these should be given freely. Patients sometimes prefer water slightly acidulated with the juice of lemons or limes, or with a few drops of dilute phosphoric or hydrochloric acid.

Alcoholic stimulants are required in the greater number of the cases of relapsing fever. The dose and its frequency must be regulated by the prostration of the patient, the character of the pulse, the impulse and systolic sound of the heart. Alcohol is especially indicated at the time of the crisis and in the early days of the intermission. Prompt and free stimulation with alcohol, spirit of chloroform, ammonium carbonate, and the external application of artificial heat may at the crisis be necessary to avert threatening collapse.

From the outset depressing measures are to be avoided. The venesection of a former period is no longer to be considered. From the time that relapsing fever was distinguished from typhus it became evident that the critical defervescence on the fifth or seventh day ascribed to depletion was not the result of treatment, but an event in the natural course of the disease. The application of leeches for the relief of headache is mentioned only in condemnation.

Quinin, arsenic, and the salicylates have been found without effect upon the duration of the primary attack or in averting the relapse. The sulphites, the hyposulphites and the preparations of chlorin are likewise without effect.

There are points of resemblance between relapsing fever and the malarial diseases which justify the hope that in time there may be brought to light a specific remedy, the action of which shall correspond to the action of quinin in the latter diseases. The therapeutic search for such a remedy has thus far, however, been without result. The modern analgesics, antipyrin, antifebrin,

and phenacetin, employed in recent epidemics in Russia have failed to yield satisfactory results.

The high temperature of the relatively short paroxysms of relapsing fever has, like that of frank cases of croupous pneumonia, been usually unattended with directly disastrous results. It is probable that in future epidemics systematic cold bathing will be more thoroughly tested than heretofore. Cold applications to the head by means of the ice-cap have proved useful in mitigating the headache. They should be continued only during the paroxysms of pain. For the relief of this symptom opium and its derivatives are also to be employed. Hypodermic injections of morphin in combination with atropin are to be preferred. Parry and other observers have noted a remarkable tolerance of the preparations of opium during the attack. Sleeplessness may be met by the cautious administration of chloral hydrate in moderate doses, its depressing effect being counteracted by the free use of alcohol.

The muscular and articular pains, which constitute such distressing phenomena of the disease, are mitigated by frequent frictions with anodyne liniments. For this purpose the following prescription is available:

℞ Chloralis hydratis, ʒss–j (16.–32.);
Linimenti saponis camphor., fl ʒvj (180.).—M.

Or a lotion consisting of 1 part of chloroform and 2 of olive-oil may be employed. Vomiting and epigastric pain may be relieved by the administration of fractional doses of calomel or the salts of bismuth in combination with minute doses of morphin. In conjunction with these remedies sinapisms, small blisters, or hot fomentations may be applied to the epigastrium. Pain in the region of the spleen may be relieved by the application of poultices or, better, of the ice-bag. The jaundice demands no especial treatment. Diarrhea if moderate should not be checked. If severe it may be controlled by the administration of large doses of bismuth together with suppositories of opium.

Obstinate hiccough sometimes constitutes a distressing symptom. It will usually yield to the administration of chloroform, epigastric counter-irritation, or a few whiffs of amyl nitrite.

Bronchitis occurring as a complication is usually mild and does not require especial treatment. Croupous pneumonia or broncho-pneumonia is to be treated upon general principles. Intercurrent pneumonias constitute a positive indication for increased stimulation.

The anemia of convalescence from relapsing fever is to be treated with an abundance of wholesome, nutritious food, the vegetable tonics, preparations of iron, arsenic, and cod-liver oil. If after convalescence the spleen remains enlarged, inunctions of the ointment of red mercuric iodid are to be employed.

# THE PLAGUE (BUBO-PLAGUE).

By J. C. WILSON.

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The plague, which has continued to smoulder in the Orient, raged with great severity in Hong Kong in the spring and summer of 1894. The disease is said to have reached Canton from Northern India by way of Thibet. During this epidemic Kitasato and Yersin, working independently, succeeded in isolating a bacillus supposed to be the cause of the disease. This bacillus consists of a short rod with rounded ends and possesses a capsule. It resembles the bacillus of chicken-cholera. It is stained by anilin dyes, the ends more deeply than the middle. It is described by Kitasato as being motile. It grows upon blood-serum, agar, and glycerin-agar, best at a temperature between 36° and 39° C. (96.8°–102.2° F.). The blood contains the bacilli in small numbers, while the lymph-glands, spleen, liver, lungs, brain, and intestines show its presence in abundance. In inoculations from the organs a single organism in pure culture was invariably obtained. The following conclusions are appended to Kitasato's report:

1. In the plague, bacilli are found in the blood, glands, and viscera.

2. This particular bacillus is not found in any other disease.

3. Obtained in pure culture it is capable of producing in inoculated animals the same effects as in human beings.

4. It gains entrance into the body through (*a*) the respiratory tract, (*b*) excoriations of the surface, (*c*) the digestive tract.

5. The disease prevails especially under faulty hygienic conditions; it is therefore urged that general hygienic measures be carried out. Proper receptacles for sewage should be provided; a pure water-supply afforded; houses and streams are to be cleansed; all persons sick of the disease isolated; the furniture of the sick washed with a 2 per cent. carbolic-acid solution in milk of lime; old clothes and bedding are to be steamed at 100° C. (212° F.) for at least one hour, or exposed for a few hours to sunlight. If feasible, all infected articles should be burned. The evacuations of the sick are to be mixed with milk of lime; and those who die of the disease are to be buried at a depth of 3 meters, or, preferably, cremated. After recovery the patient is to be kept in isolation at least one month. In one case Kitasato was able to demonstrate bacilli in the blood after the third week. All contact with the sick is to be avoided, and great care is to be exercised with reference to food and drink. During the recent epidemic domestic animals, flies, and particularly rats died in great numbers.

The period of incubation is from two to seven days. In the report of the

Commission of the French Academy of Medicine drawn up by Proust in 1844 it is stated that the plague has never shown itself among compromised persons after an isolation of eight days. Arnaud concluded from observations made at Benghazi in 1874 that the mean duration of this period was five or six days and that the maximum did not exceed eight days. Cabiadis makes this stage three days as the rule, but as occasionally not exceeding twenty-four hours. Hirsch, from information collected in his investigation of the epidemic at Astrakhan, concluded that the minimum period of incubation was from two to three days, the maximum more than eight and the average five days. He states that the very short and very long periods were seldom observed.

The chief predisposing influences are to be found in that combination of physical and social wretchedness which attends poverty and overcrowding. The plague has been termed by Cabiadis *morbus miseriæ* and the great plague of London was called "the poor's plague." Ignorance and neglect of sanitary laws, over-crowding, personal filthiness, improper and insufficient diet, accumulations of human excreta and other filth in and around dwellings, unburied or imperfectly buried corpses in the neighborhood of human habitations, have been enumerated as constituting conditions favorable to the prevalence of the plague. The condition of localities that have been the scenes of some of the modern epidemics beggars description.

Individual predisposition to the disease is increased by depressing influences such as bodily or mental over-exertion, intense and prolonged anxiety and fear. Physicians, nurses, and others occupied in the care of the sick and those who bury the dead have especially suffered, in recent as in the older outbreaks. It has been stated that oil-carriers and dealers in oils and fats, water-carriers, and the attendants at baths enjoy comparative immunity from attack.

**Prophylaxis.**—An efficient prophylaxis consists, first, in the removal of the conditions favorable to the development of the disease, and, second, in the restriction of the disease by quarantine to the locality in which it has shown itself. In the words of Hirsch, "The extinction of the plague in Europe was a gradual process, and kept pace in great measure with the development and perfection of the quarantine-system with reference to the Orient and the different countries of Europe." This author goes on to say, "I cannot in fact understand how any one criticising the facts without prejudice and having regard to the state of the plague in the East can for a moment hesitate to attribute the general cause of the disappearance of the plague from European soil to a well-regulated quarantine-system." As a cause of scarcely secondary importance, however, we must invoke the improved methods of living of a progressive civilization. The European has not lost his susceptibility to the plague. He is liable to attack in the East. His immunity at home is to be found in the restriction of the exciting cause of the disease to its present haunts. There can be little doubt that the rigorous quarantine established at the town of Noja in lower Italy in 1815, and similar measures of isolation practised on the Volga in the province of Astrakhan in 1878–9 prevented this disease from entering Europe. As already pointed out in Flexner's transla-

tion of the report of Kitasato, the complete disinfection of all clothing and other articles used in the service of the sick is a necessary measure of prophylaxis. It has not been uncommon to destroy by fire the houses in which cases have occurred, together with their contents.

**Treatment.**—The management of individual cases must be expectant and symptomatic. Ventilation, cleanliness, a liquid diet systematically administered, and abundant cool drinks form the basis of the treatment. The early collapse and evidences of failure of the forces of the circulation call for the free use of stimulants and especially of alcohol. Cold or tepid sponging, in accordance with the sensations of the patient, may also be employed. Cold affusions are said to have been of use in many cases, and the rhythmic effects of systematic cold bathing according to the method of Brand should be obtained.

Emetics, blood-letting, purging, mercurials, and blisters have proved altogether without effect upon the course of the disease and are to be avoided as harmful as well as useless. Ammonium chlorid, the salicylates, carbolic acid, and quinin have proved ineffectual alike to modify the progress of the attack and to mitigate the symptoms.

Various plans have been employed in the management of buboes. Leeching, inunctions of mercurial ointment, incision and excision have shown themselves to be equally useless. If suppuration take place the pus is to be evacuated early and drainage established in accordance with the requirements of modern surgery. Carbuncles are to be treated in the same way.

The disease is of short duration and very fatal. In the fulminant form the duration of the whole attack is often not more than a few hours. In the grave or ordinary form the resources of medicine are inadequate to modify the attack or avert the fatal issue in the large proportion of cases. The milder symptoms and the longer duration of the larval or abortive cases afford an opportunity for symptomatic treatment and careful nursing.

# CEREBRO-SPINAL FEVER (CEREBRO-SPINAL MENINGITIS).

By J. C. WILSON.

In the present article the treatment of so-called idiopathic cerebro-spinal fever in its epidemic and in its sporadic form is considered. The term epidemic cerebro-spinal meningitis is misleading, as the disease not infrequently occurs in sporadic cases. The treatment of tuberculous meningitis, lepto-meningitis occurring in connection with the acute infectious diseases, the meningitis of alcoholism, syphilis, sun-stroke, that resulting from the extension of nasal and middle-ear disease, traumatism, and caries is considered elsewhere under the appropriate headings.

The presence of the micrococcus lanceolatus in the purulent exudate sheds light upon the pathology of the disease, but has thus far not led to any definite advance in its therapeutics.

Flexner and Barker, who recently investigated an important outbreak at Lonaconing, Md., regard it as probable that infection takes place by way of the blood-current rather than by continuity from the nose or ear. The not infrequent association of meningitis and pneumonia serves to sustain this view. These observers, without overlooking the possibility that infection may take place from the nasal and aural cavities, believe that in the cases that occur without pneumonia, as is usual in the epidemic form, the intestinal tract may in many instances be the point of access. They support this opinion by the fact that in two of the cases that they observed, and that terminated fatally, there was dysentery, and that in one of these, cultures and cover-slip preparations of the evacuations showed the predominating organism to be the micrococcus lanceolatus. Dysentery has been noted in other epidemics. In view of the extraordinary anomalies in the prevalence and spread of epidemics, and the wide prevalence of the organism in nature, Flexner and Barker attribute the continuance of the disease to "predisposition of community" rather than "infection of locality."

**Prophylaxis.**—It is in accordance with this view that cerebro-spinal fever, like other epidemic diseases, usually assumes its worst form and claims the greatest number of victims in localities where unsanitary conditions prevail. Personal predisposition is enhanced by unwholesome living and unfavorable surroundings, and the impaired resistance of the tissues of the individual that results therefrom. At times of epidemic the thorough cleansing of streets and dwelling-places, attention to the condition of the drainage, the proper disposition

of the sewage, the prompt removal of refuse matters, and the avoidance of overcrowding are measures that should at once be instituted in the hope of diminishing the severity and mortality of the disease. The successive attack of different members of the household in consequence of some unknown favoring condition of the surroundings renders it desirable that when practicable the dwellings in which the disease has made its appearance should be abandoned until after the close of the epidemic. All linen and other articles used by the patient should be disinfected or burned; careful attention should be given to all matters of personal hygiene; the food should be plain, wholesome, and sufficiently abundant; unusual fatigue both of body and mind and excesses of every kind must be avoided. Moderate exercise and regular living may diminish the liability of the individual to the attack, but may by no means ensure immunity. It is desirable that persons in feeble health, and especially those suffering from diseases of the nose, throat, and ear, and from intestinal diseases should, upon the appearance of an epidemic, leave the infected district.

**Treatment.**—No one who has investigated the records of this remarkable disease or observed it in extensive outbreaks can fail to be impressed by the diversity of its manifestations. Stillé, who well called it a chameleon-like disease, grouped the cases under the following headings: (A) The abortive, (B) the malignant, (C) the nervous, (D) the inflammatory, and (E) the intermittent. The group (C) of nervous cases is subdivided into (*a*) the ataxic, comprising (1) the delirious, (2) the cephalalgic, (3) the neuralgic, (4) the convulsive, (5) the paralytic; and (*b*) the adynamic, comprising (1) the comatose, (2) the typhoid. Other clinicians have adopted simpler and more satisfactory classifications. Perhaps the best is that of Bartholow, who grouped the cases into the ordinary or common, the fulminant, the petechial, and the abortive. Cerebro-spinal fever shows not only the variations in intensity observed in other infectious diseases, but also variations due to morbid manifestations arising from varying combinations of two severe pathologic processes—first, an acute exudative inflammation of the cerebro-spinal meninges, and second, a profound toxemia. It cannot be a matter of surprise, then, that the treatment of the disease has been almost as various as its forms. To this unsatisfactory state of affairs the personal views of practitioners and the phases of fashion in therapeutics have contributed each an important share. At different periods and in different localities, wholly dissimilar and even opposite methods of treatment have been adopted. Those to whom the disease has presented from the outset marked symptoms of depression have chosen a vigorous, supporting plan of treatment; to others the energetic use of depletory and other antiphlogistic remedies has seemed necessary to control the urgent symptoms of an intense inflammatory process implicating the membranes of the brain and spinal cord and the subjacent nervous matter. The unsatisfactory results of both these plans have confirmed the position of those practitioners who have preferred a modified expectant plan of treatment consisting of a careful regimen, together with efforts to combat serious symptoms as they arise.

The attempt to deduce from statistics conclusions in regard to the comparative value of different modes of treatment in a disease in which the mortality ranges between 30 and 75 per cent. in different outbreaks must yield unsatisfactory results. Comparisons of the results of treatment in different epidemics must necessarily be fallacious. Indeed, more than this, the capricious nature of the affection and its various manifestations render it useless to compare cases in the same epidemic or even to compare the cases that occur during the rise, prevalence, and decline of epidemics. Even cases in which the intensity of the morbid phenomena and the rate of mortality justify the term "average" differ among themselves by as many shades as there are varying combinations of the toxemia and the local inflammatory elements. Thus, there are cases in which the attack is of the mildest form, the true nature of which can only be recognized in the light of the epidemic in which they occur. These cases require no treatment, not even in some instances compelling the patient to take to his bed. In strong contrast to such cases are those in which the patient in his ordinary health, on awaking from sleep or while at his usual occupation, is suddenly overwhelmed by the affection as by a lightning-stroke, and, passing rapidly from agonizing suffering to coma, perishes in the course of a few hours. The rapid course and the nature of the lesions in these cases render all efforts of treatment powerless. Medicine, with all its resources, is neither capable of combating the attack nor responsible for its results. Of this group of cases Stillé has said: "The first symptoms of the disease are the first phenomena of death." We are compelled, then, in estimating the results of treatment, to base our conclusions upon the effect of remedies in individual cases, their immediate influence upon subjective and objective symptoms, with the permanence of their effects. From this we conclude that a judicious treatment must be based upon the broad general principles of therapeutics.

The room occupied by the patient should be darkened and kept quiet. The alimentation should from the beginning of the attack be generous. During the continuance of the febrile phenomena milk, eggs, meat-juice, and broths should be given at regular intervals and continued in severe cases during the night. In those cases in which food cannot be taken by the mouth nutritious enemata should be administered. Water, as in all the acute infectious febrile diseases, should be freely administered.

Alcohol is required at some time in the course of almost all cases; its indiscriminate use, however, in the treatment of this affection, independently of the indications that govern its employment in the general management of the acute infectious diseases, has not been followed by satisfactory results. Alcoholic stimulants are to be promptly administered when the symptoms of depression of the nervous system appear, whether at the onset of the attack or later. The guide as to their amount is the effect upon the character of the pulse and the first sound of the heart. If after the administration of alcohol the pulse becomes more regular, stronger, fuller and less frequent, and the first sound of the heart more distinct, the use of the remedy is to be continued. If the pulse increases in frequency, the action of the heart becomes more

excited and irregular, the tongue grows dry and restlessness is augmented, the alcohol may even be tentatively increased, but a continuance of these symptoms may render it desirable to reduce the dose or even to abandon alcoholic stimulants altogether. In cases in which the patient is unable to swallow, whisky or brandy may be administered by hypodermic injection.

Blood-letting was, in the early history of cerebro-spinal fever, very generally practised. Venesection is in no case admissible. In view of the infectious character of the disease, its rapidly disintegrating effect upon the blood, the early and often alarming debility in some cases, the marked depression that in others follows the subsidence of the active symptoms, the great emaciation and tedious convalescence, measures of depletion must be employed with the greatest caution, and are in the majority of cases wholly contraindicated. In children the abstraction of small quantities of blood is liable to be followed by alarming symptoms of depression. Even in robust individuals wet-cups to the nape of the neck and along the spine, while followed by temporary relief of pain, are to be employed with caution. Leeches may be applied to the temples and in the neighborhood of the mastoid processes. It is, however, to be noted that the condition of the circulation is almost always, even from the onset, such as to contraindicate the abstraction of blood, and while the urgency of the inflammatory symptoms, the intensity of the headache, and the critical condition of the patient seem to demand the employment of energetic measures, the clinical history of the disease warns the physician that marked depression is shortly to follow and suggests due regard for the future. These remarks do not apply to dry-cups, the use of which is occasionally followed by mitigation of the pain.

The continuous direct application of cold to the head and spine is of value. Ice-bags or Leiter's coils may be employed for this purpose, or a bladder filled with cracked ice mixed with bran. This procedure is in many instances followed by marked mitigation of the pains and sometimes by quietude or sleep. It should be kept up as long as the patient derives comfort from it, and repeated upon the return of the symptoms. Cold affusions or cold sponging also may be employed, and if the fever be high, systematic cold bathing. In children, gentle cold affusions may be cautiously practised. During the application of cold to the head and spine or immediately after cold affusions or baths the patient should be covered with warm blankets and artificial heat applied to his sides, thighs, and extremities. This may be accomplished by hot flannels, bags of hot sand or salt, bottles filled with hot water, or heated bricks or billets of wood well wrapped up. At the same time, if necessary, sinapisms may be applied to the extremities and the precordium. Stimulating enemata may likewise be administered at this time. Bartholow suggested that the application of ice to the head and spine may do mischief by depressing the circulation. He advises the use of hot water applied by a sponge passed over the spine at intervals of two or three hours. Modern American practitioners agree in advising the continuous employment of external heat to anticipate and counteract the quickly oncoming depression, a practice very generally employed

in the early epidemics in this country, but long strangely overlooked here and altogether neglected in Europe.

Blisters upon the occiput and nape of the neck, applied early in the course of the disease, have appeared to be of service in relieving pain and in diminishing the tendency to delirium, spasm, and coma. They should be carefully watched and immediately removed upon the development of signs of vesication. Deep blistering does not enhance their effect and greatly adds to the discomfort of the patient. It is moreover liable to be followed by troublesome sloughing. Equally desirable results may be obtained from the like application of the thermo-cautery.

Mercury is useless except in the form of a dose of calomel as a purgative at the onset of the attack. This metal in various forms has been employed to a great extent in the treatment of cerebro-spinal fever. Its employment for an antiphlogistic or antiplastic effect or for an absorbent effect upon the exudation no longer receives the sanction of the profession. Ziemssen commends the use of mercury in the form of mercurial ointment "for the purpose of preventing the extension of the meningeal inflammation and exudation." He employs free inunctions and the internal use of calomel in almost every case, but admits that when used in connection with other remedies it is difficult to ascertain its share in the common effect, and that even when used alone its efficacy is by no means clearly established.

Quinin in large doses has been extensively employed. There is, however, no reason to believe that it exerts any favorable influence upon the course of the disease, even in the intermittent variety. Its administration late in the course of the disease, when the phenomena point to intracranial exudation, is useless, even hurtful, save in small doses as a tonic to an enfeebled system. The statement that this drug has appeared to abort the disease in some instances is not borne out by sufficient evidence.

Opium holds among drugs the highest place in the treatment of cerebro-spinal fever. It was generally employed in America in the early part of the present century, adopted in France at a later period, and has recently been employed in Germany. Ziemssen says of morphin that it "may be regarded as one of the more indispensable remedies in the treatment of epidemic meningitis." The indications for the use of opium are to be found in the headache and spinal pains, restlessness, spasm, hyperesthesia, and sleeplessness. It is to be employed at the earliest moment and in full doses. Experience has demonstrated a remarkable tolerance for this drug in cases of cerebro-spinal fever. Large doses were given by the older physicians. Strong gave in one case 60 drops of laudanum every half-hour until half a fluidounce (15.) was taken. This large quantity was retained and subdued the excitement and relieved the pain, but produced no sleepiness or other apparent effect of opium. Other early American physicians gave enormous doses, half an ounce of the tincture of opium (15.), or from 30 to 60 grains (2.–4.) of the crude drug, in the course of twelve hours. These large doses were frequently followed by recovery. Chauffard administered opium in doses of from 3 to 15 grains

(0.19–1.). Boudin frequently gave from 7½ to 15 grains (0.5–1.) at a single dose at the beginning of the attack, and afterward from 1 to 2 grains (0.065–0.13) every half-hour. As soon as the symptoms abated and the patient became drowsy the dose was diminished. Stillé gave one grain (0.065) every hour in grave cases and every two hours in moderately severe cases, without even an approach to narcotism. He adds that "under the influence of the medicine the pain and spasm subsided, the skin grew warmer and the pulse fuller, and the entire condition of the patient more hopeful." This use of opium in cerebro-spinal fever corresponds with its employment by the late Alonzo Clark and his followers in puerperal peritonitis. The remedy is to be given for effect and the amount necessary to produce an effect is to be administered. Its greatest usefulness is to be obtained only by its administration early in the course of the disease. Upon the appearance of symptoms indicative of exudation the utility of opium is greatly diminished and it must be given in more guarded doses. It is a notable fact respecting the use of opium in cerebro-spinal fever that the early American physicians did not hesitate to administer it in cases in which coma threatened—a condition usually thought to preclude the use of narcotics. Strong and others have recorded their opinion that it is a powerful agent in obviating coma in cases such as are not "absolutely irrecoverable." When the condition of the patient is such as to render the administration of opium by the mouth impracticable, or when repeated vomiting prevents its absorption, the drug may be given in the form of enemata or suppositories, or one of the salts of morphin may be administered hypodermically. The latter is in most cases the best plan of treatment, and a hypodermic injection of morphin morning and evening, with the administration of suitable doses of the deodorized tincture in the intervals, constitutes a useful method of treatment. When there is great restlessness and jactitation the hypodermic injection of morphin with hyoscin hydrobromate is indicated. In the case of children the dose must be cautiously regulated.

Ergot and belladonna have been used upon theoretic grounds. The results of their administration have not been satisfactory.

Cannabis indica, the fluid extract of gelsemium, large doses of chloral hydrate, zinc oxid, and inhalations of chloroform have been employed during the stage of excitement.

The bromids are useful in the treatment of mild cases and in the management of children. They may with advantage be combined with opium or morphin.

Caution is to be exercised in the treatment of cerebro-spinal fever in the use of sedatives that exert a depressing influence upon the circulation.

Inhalations of ether are to be judiciously employed for the purpose of securing temporary relief from the torturing pain, jactitation, and spasm.

Veratrum viride and aconite have been employed upon false theories as to the pathologic processes in cerebro-spinal fever. These drugs are mentioned in this connection only to emphatically condemn their use under any circumstances in this disease.

The modern analgesics may be employed either alone or in conjunction with opium and its derivatives in the management of the milder cases of the disease. Large doses are to be avoided.

In the stage of depression stimulants are to be freely given. Preparations of alcohol, ammonium carbonate, aromatic spirit of ammonia, spirit of chloroform, and turpentine are useful. Cold affusion may be practised several times a day.

During convalescence the bitter tonics and iron are to be employed. Arsenous acid or Fowler's solution of potassium arsenite are also useful. In certain cases cod-liver oil is indicated, and potassium iodid has been given under the belief that it hastens the resorption of the exudate. To be of use the last-named drug should be administered continuously. It is useless in the treatment of cerebro-spinal fever during its acute course.

Flying blisters are to be applied over the mastoid processes and in the occipital region, together with daily hot affusions to the nape of the neck and base of the skull. When the acute symptoms have ceased, mild continuous galvanic currents may be employed.

Delirium, spasm, and irritability of the stomach too often in the severe cases render the administration of medicine and food impracticable.

As soon as practicable an abundant, easily digested, nutritious dietary of mixed solid food should be administered. During convalescence the appetite is often excellent. At this period in the course of the disease the patient is to be guarded against assuming the erect posture or even sitting upright in bed, on account of the danger of syncope. Constipation is to be relieved by a dose of calomel, salines, or other simple drugs or by enemata. Neither constipation nor diarrhea is, as a rule, difficult of management.

Basal exudates undergoing organization frequently manifest themselves by permanent palsies of cranial nerves, among which blindness, squint, and deafness are not uncommon. Deaf-mutism may arise in consequence of an attack of cerebro-spinal fever in early infancy.

The use of potassium iodid, mercurial inunctions, flying blisters, and the thermo-cautery, together with galvanism, hydrotherapy, and carefully regulated hygienic and dietetic measures, have in rare instances appeared to promote resorption of the exudate and bring about a gradual amelioration of grave symptoms.

# CHOLERA INFECTIOSA (ASIATIC CHOLERA).

By E. O. SHAKESPEARE.

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**Definition.**—*Cholera infectiosa* is, as the name implies, an infectious disease. It is first localized in the intestinal canal, but it rapidly becomes systemic through the absorption into the general circulation of highly toxic substances elaborated in the growth and multiplication of a specific microbe, numbers of which, during the prodromal period and the active course of this disease, swarm in the intestinal canal and constitute the active cause of the disease. The intestinal contents, as also frequently the contents of the stomach, of a person suffering with an attack of cholera are infectious, by reason of the presence of enormous numbers of the specific pathogenic microbes. Not only is the temporary host of these minute vegetable parasites infected through their agency, but he is capable also of indirectly infecting and reproducing the disease in other susceptible persons who, under favoring conditions, in any manner ingest the living, active microbes in sufficient numbers.

*Cholera infectiosa* is usually characterized at first by abdominal uneasiness associated with looseness of the bowels, which condition, if unchecked, rapidly develops into a stage of copious rice-water-like discharges from the bowels, associated or not with vomiting and cramps in the limbs and the trunk, and with a strong tendency to great prostration and marked coldness of the superficies and to duskiness or lividity of the skin and loss of voice. These conditions, if not speedily remedied, soon advance into a state of profound prostration and collapse, with marked algidity, lividity, and shrunken skin, to be followed quickly by death, by a convalescence more or less rapid, or by a period of secondary septic fever. One or more of these successive stages may be absent; so also may the abdominal discharges. Nausea, vomiting, and violent cramps are frequently present and are exceedingly distressing.

**Etiology.**—There is little difference of opinion to-day as to the etiology of *cholera infectiosa*. It is almost universally admitted that the essential causative factor is the comma-bacillus of Koch—that is, that there can be no contagious or transmissible cholera in the absence of this micro-organism. Although *cholera infectiosa* has often been classed as one of the filth-diseases, no amount of common filth either in the surroundings or in the food or the drink is capable of producing a genuine attack of this disease; nor can common filth generate the specific germs or poison that constitutes its active cause. In other words, without the presence and active agency of the specific microbe of this

disease an attack of *cholera infectiosa* cannot occur. On the other hand, few deny that cholera-organisms may be present in the individual case without necessarily engendering the disease, and that other influences—telluric, meteorologic, and individual—may contribute more or less to, or antagonize, the development and spread of a local epidemic; but just how much importance is to be attached to each of the latter influences is perhaps beyond even approximate computation at the present time. Modern bacteriology has shown that the same micro-organism varies in degree of pathogenicity and virulence, and to some extent in morphology also, under different conditions, and it is a matter of common observation that different persons display varying degrees of susceptibility or resistance to the invasion of this as of other forms of disease; furthermore, the dose of the cholera-infection imbibed or ingested varies greatly. It is for these reasons that in a given epidemic the intensity of the individual attack varies much, from the severest to the mildest, while a large portion of the community always escapes entirely the development of any visible symptoms.

The symptoms and the phenomena of *cholera infectiosa* are due in part to the local action of the invading organisms and in part to the absorption of toxic matters engendered in the intestinal canal as a result of their vital activity. The local condition is one of infection or excoriation of the intestinal mucous membrane; the constitutional state is one of intoxication. This distinction is all-important, as it has a significant bearing on the therapeutic indications.

There is no reason to believe that cholera is acquired in any other manner than through the intermediation of the gastro-intestinal tract; on the contrary, the evidence compels the acceptance of this view. Biologic investigation has shown that the comma-bacillus ill withstands the action of acids, so that in health the stomach stands as a safeguard against invasion, if the latter is attempted during acidity of the gastric fluids. If, however, the organisms are introduced in large number, or if, for some reason, the gastric juice is deficient in acidity, the live microbes pass the pylorus and gain entrance into the intestinal canal, where they find the chemic and nutritive and other conditions favorable for their development and multiplication. Cholera-germs swallowed during the intervals of digestion are less likely to be destroyed in the stomach, for the gastric juices are then usually neutral or even slightly alkaline.

**Mode of Transmission.**—The most common and the usual channel through which cholera is transmitted to individuals, especially during sudden and rapidly spreading epidemics, is contaminated water used for drinking, cleansing, adulteration, bathing, etc. Though transmissible from the sick to the well, cholera is not in the ordinary sense of the word contagious. Thus, cases may arise from more or less direct contamination among those in close attendance upon the sick, and who must handle the patient and his clothing and dispose of his excreta, and among those who wash the soiled linen of the sick. It has very frequently been observed that those who unpack or otherwise handle cholera-infected clothing or wear it are especially liable to be seized with an attack of cholera. The disease may also be transmitted by eating uncooked

vegetables that have been sprinkled or washed with contaminated water, and by milk that has been diluted or whose receptacles have been washed with such water; but the most prolific mode of infection is the direct ingestion of water that has been defiled by cholera-discharges. It should be noted in this connection that the cholera-microbe is capable of living in water and in milk for a long time under favoring conditions, and not infrequently of multiplying enormously therein. Thus, contaminated milk may become far more dangerous to the consumer who takes it raw than is even the contaminated water that is used in diluting it or in washing the vessels containing it. Next to a contaminated water-supply is a contaminated milk-supply productive of the rapid development of epidemics of *cholera infectiosa;* but in the latter case the epidemic focus is limited, of course, more or less closely, especially at first, to the consumers of the infected milk. The cholera-organism is rather a sensitive one, soon losing its activity when dried or exposed to the influence of direct sunlight, of acids, and of nearly all disinfectants.

**Management.**—The management of *cholera infectiosa* may advantageously be considered under two general heads: (1) prophylactic; (2) therapeutic. The prophylactic management should be (*a*) general or civic, and (*b*) special or individual.

*General Prophylaxis.*—The measures of general or civic prophylaxis to be adopted in times of a threatened invasion of cholera, and with redoubled care during the prevalence of an actual epidemic, include judicious and efficient external quarantine, rigid local and domestic sanitation, the provision of a water-supply above all suspicion, the insurance of adequate drainage, the immediate disposition of all refuse and other matter liable to undergo decomposition, the institution of frequent house-to-house inspections, and insistence upon the most scrupulous general cleanliness, the proper disposal of the dead, and generous provision for and intelligent care of the sick. In case the water-supply or the milk-supply be at all suspicious, the milk and the water used should be sterilized by heat before drinking.

The principles that govern the management of an outbreak of cholera are expressed in the two words *isolation* and *disinfection.* I cannot do better at this point than reproduce the general measures recommended in my *Report on Cholera in Europe and India* (Washington: Government Printing Office, 1890) for the prevention of the disease, and which are as follows:

(*a*) Speedy recognition and isolation of the sick; their proper treatment; absolute and rapid destruction of the infectious agent of the disease, not only in the dejecta and the vomit, but also in clothing, bedding, and in or upon whatever else it finds a resting-place.

(*b*) The convalescents should remain isolated from the healthy so long as their stools possibly contain any of the infecting agent—say for from ten to fourteen days after the commencement of the attack; before mingling again with the healthy they should be well washed and immersed in a disinfecting bath, and afterward be clothed from the skin outward with perfectly clean vestments which cannot possibly carry any infectious material.

(*c*) The dead should be well wrapped in a cloth thoroughly saturated in a solution of corrosive sublimate, 1 : 500, and without delay, cortège, or lengthy ceremonial should be buried, near the place of death, in a deep grave remote as possible from water, either surface or underground, which is liable under any circumstances to be used for drinking, washing, culinary, or other domestic purposes. (Cremation, of course, is by far the safest way of disposing of cholera-cadavers.)

(*d*) Those handling the sick or the dead and their used articles of clothing or bedding should be careful to disinfect their hands and soiled clothing at once, and especially before touching articles of food or drinking or culinary vessels.

(*e*) In case of maritime quarantine the healthy should be disembarked and placed under observation in quarters spacious enough to avoid crowding, and so well appointed and furnished that none will suffer real hardships.

(*f*) Once having reached the quarantine station, those under observation should be separated in groups of not more than from twelve to twenty-four, and the various groups should under no pretext intermingle; the quarters for each group should afford stationary lavatories and water-closets, in perfect working condition, adequate to the needs of the individuals constituting the group, and supplied with proper means of disinfection; there should be a bed raised above the floor, proper coverings, and a chair for each member of the group, each person being required to use only his own bed; there should be a common table of sufficient size to seat around it all the members of the group, who should be served their meals from a central kitchen and with table-furniture belonging to the station and cleaned by the common kitchen-scullions of the station.

(*g*) Drinking-water, free from possible contamination and of the best quality, should be distributed through metallic pipes under constant pressure in the quarters of each group, as it is needed and in such a manner that it is received in drinking-cups only; there should be no water-buckets or other large vessels in which handkerchiefs, small vestments, children's diapers, etc. can be washed by any members of the group.

(*h*) Immediately after being separated into groups in their respective quarters every person under observation should be obliged to strip and get into a bath (a disinfecting one is preferable), and afterward be clothed with fresh, clean vestments from the skin outward. Every article of clothing previously worn should be promptly taken away and properly disinfected without delay.

(*i*) Then all the personal effects should be at once removed to a separate building, washed—if possible—and thoroughly disinfected, or, if necessary, destroyed. After disinfection they should be temporarily returned to the members of the groups when occasion requires a further change of clothing.

(*k*) Under no circumstances whatever should washing of clothing by those under observation be permitted. All used clothing should be first thoroughly disinfected (by boiling when possible) and then should be cleansed, the disin-

fection and washing being done by a sufficiently trained and absolutely reliable corps of regular employés supplied with adequate appliances.

(*l*) All those under observation should be mustered in their own quarters and be subjected to a close medical inspection *while on their feet* at least twice every day, in order to discover and isolate as soon as possible new cases that may develop; and, of course, the clothing and bedding of these new cases should be treated without delay in the manner already mentioned. In the mean time a watch should be set over the water-closets for the purpose of discovering cases of diarrhea, and, when discovered, such cases should be temporarily separated from the rest; they should receive judicious medical attendance at once, and precautions should be taken as if they were undoubted but mild cases of cholera.

(*m*) The quarters should be kept thoroughly cleaned, and every surface upon which infectious material could possibly be deposited, including the floors, should be washed with a strong disinfectant twice daily, and oftener when necessary; evacuations from the bowels should be passed into a strong disinfectant; the hopper of the closet should then be flushed, and finally drenched with a quantity of the same disinfectant.

(*n*) For the proper attention to the sick there should be two or more competent and experienced physicians, assisted by a sufficient corps of intelligent and efficient nurses, with hours of duty so arranged that a physician, with a sufficient number of nurses, is in constant attendance in the wards of the hospital.

(*o*) For the prompt recognition and separation of new cases, their temporary medical attention, the proper treatment of newly discovered cases of diarrhea or cholerine and of other maladies, and the immediate correction of every unsanitary practice or condition by constant and intelligent supervision, there should be at least two or more competent and experienced physicians, with hours of service so arranged that a physician is on duty night and day among those under observation; and he should have subject to his order at any and every moment a sufficient and efficient corps of nurses and laborers to carry out properly and promptly his directions.

(*p*) In order to prevent the intermingling of the various groups, to enforce obedience and order, and to make it absolutely impossible for the quarantined and their personal effects to have any communication with the exterior, a well-organized and sufficiently large police corps should patrol the borders of the stations and the buildings day and night.

(*q*) Any group among whom there have developed no new cases of cholera or of choleraic diarrhea during the preceding six or eight days may be regarded as harmless, and be allowed to leave quarantine after each one is finally immersed in a disinfecting bath and re-clothed with clean garments from the skin outward, the garments removed being destroyed or thoroughly disinfected and cleansed as already indicated.

What has been said of the management of those under observation applies to every one of the ship's inhabitants, but more especially to the immigrant

class. The observation, isolation, and cleansing of the crew and their effects could safely be performed on board ship, if necessary. The ship should be thoroughly cleansed and disinfected, particular attention being given to the quarters of the emigrants and crew.

The following agents are recommended in the instructions issued by the Prussian government for the disinfection of the excreta, the clothing, and the surroundings of cholera-patients: (1) Milk of lime (1 part of lime to 4 of water): this is to be kept in a well-covered vessel and to be stirred before being used. (2) Chlorinated lime, freshly prepared and well kept. Evidence of its good quality is furnished by its strong, peculiar, pungent odor. It can be used in the form of a powder or in a solution of 2 parts to 100 of cold water. The solution should be allowed to settle, the supernatant fluid being poured off and used. (3) Potash-soap in 3 per cent. solution. (4) Carbolic acid. The crude acid is not available. The so-called "100 per cent." acid is a convenient form, and is quite as efficient as the pure acid: 1 part is added, with constant stirring, to 20 parts of a 3 per cent. solution of potash-soap. If the pure acid is used, it may be added in similar proportions to simple water. (5) Steam under pressure of not less than a tenth of an atmosphere. (6) Boiling water.

Articles capable of such treatment may be disinfected by boiling for at least half an hour, the water boiling constantly and the articles being completely covered. Discharges from the bowels or the stomach should be received, as far as possible, in vessels, mixed with an equal volume of milk of lime, and allowed to remain in contact therewith, after careful stirring, for at least an hour. Chlorinated lime may be used, two heaping tablespoonfuls of the powder being added to each half-liter and well mixed. Disinfection with the latter is effected in fifteen minutes. The hands and other parts of the body coming in contact with infected matters and articles (discharges, soiled clothes, etc.) should be disinfected each time by thorough washing with a solution of chlorinated lime or carbolic acid (5 per cent.). Bed-linen, body-linen, and other articles of clothing that may be washed should be put into receptacles containing disinfectants immediately on being soiled. Either the solution of potash-soap or of carbolic acid may be used. In the former the clothing should remain for at least twenty-four hours, in the latter for at least twelve hours, before being rinsed and further cleansed. Steaming or boiling may also be employed, but in this case the articles must first be well wetted with the disinfectant, in order that those who handle them before disinfection may be exposed as little as possible to the danger of infection. In any event, all who touch such articles should disinfect their hands as indicated. Clothing that cannot be washed must be disinfected by steam. Leather articles may be wiped with a 5 per cent. solution of carbolic acid or of chlorinated lime. Wooden and metallic parts of furniture and articles of similar character should be rubbed carefully and repeatedly with cloths wet with a solution of carbolic acid, of potash-soap, or of a mixture of both. The floors of sick-rooms should be treated in the same way. The rags used should be burned. Floors

can also be disinfected by milk of lime, which may be washed off after two hours' contact. Walls and woodwork may be whitewashed. After disinfection the rooms should be left unoccupied for at least twenty-four hours, and should be well aired and exposed to the sunlight. The ground, pavement, and gutters which may have been fouled should receive a copious flooding with milk of lime. In privies a liter of milk of lime should be poured daily down each seat-opening. The seats should be washed with a solution of potash-soap. All receptacles in which excrement is deposited should be treated thoroughly with milk of lime inside and outside after being emptied. Articles that cannot be treated in any of the ways detailed, or when steam-apparatus or disinfectants cannot be obtained, should be put out in the sun and the air for at least six days, protected from the rain. Articles of little value—as straw bedding, for instance—should be burned; in fact, it is safest to burn the bedding after use by a cholera-patient, for it is often extremely difficult to thoroughly disinfect beds and stuffed quilts.

*Individual Prophylaxis.*—We have now to consider the question of individual prophylaxis. In times when cholera prevails, only thoroughly and recently cooked food and thoroughly and recently boiled water and other fluids should be used. Even the water intended for bathing purposes should be sterilized by thorough boiling if the water be suspected. The utmost care should be taken to guard food and drink intended for consumption from contamination by flies, as it has been demonstrated that these insects are capable of acting as carriers of cholera-bacilli. Indiscretions in diet should be scrupulously avoided. The slightest derangement of digestion or of gastric or intestinal function should receive immediate and considerate attention. The food should be simple, bland, nutritious, and well prepared. Over-exertion of all kinds should be avoided, and exhaustion of body or of mind is to be guarded against. Over-heating of the body on the one hand and chilling of the surface on the other hand should be prevented. The mode of life should be simple and regular, with long hours of rest and as great freedom as possible from care, anxiety, and excitement. Alcoholic and other vicious excesses should be avoided. To fortify the action of the gastric juice in rendering inert the comma-bacilli that may possibly be ingested, it may be well, unless it be found to interfere with digestion, to advise the free use of real lemonade or of lemonade made with hydrochloric, sulphuric, or lactic acid, preferably the latter.

With the establishment of the germ-theory of infectious diseases and the demonstration of the specific etiology of cholera, ardent search has been made for a reasonably sure preventive of cholera or for an antidote to the poisonous products of the comma-bacillus of Koch. From the time of the inoculation-experiments of Ferrán in 1884 and 1885 with cholera-bacilli until the present a host of distinguished observers has been at work upon this problem of the prevention of cholera by means of inoculation of the cholera-bacillus or its products, with results that carry with them much assurance and hope of ultimate success. Reliable statistics obtained from official sources, as shown in the

*Report* already cited, appear to support strongly the claims of Ferrán as to the protective value of his anti-choleraic inoculations. Thus, during the epidemic of cholera in Spain in the year 1885 there occurred among the villages throughout the province of Valencia an average of 62 attacks per 1000 of the population, with 31 deaths—a mortality of 50 per cent. of the attacked. Of the inhabitants of twenty-two towns, chiefly in the same province, in which inoculations were practised, 104,561 were not inoculated and 30,491 were inoculated. Among the latter the cases numbered 387, or 12 per thousand, with 104 deaths, or 3 per thousand, the mortality being 25 per cent. of the attacked; while among the former the cases numbered 8406, or 77 per thousand, with 3512 deaths, or 33 per thousand, being a mortality of 43 per cent. It is thus apparent that both the morbidity and the mortality were very much less among the inoculated than among the uninoculated. Of the more recent work in India in the same direction by Haffkine it is yet too early to speak positively, but the results, as far as they go, are also encouraging. A large number of inoculations have been made in India, but comparatively few of the inoculated have been exposed to the disease. Of those thus exposed, however, a very high percentage of the inoculated so far reported have escaped, though situated in the midst of others who under like conditions succumbed.

The details of Ferrán's method of preparation of the material for inoculation are veiled in some obscurity, but his method essentially consisted in the subcutaneous injection of living cultures of comma-bacilli. As a rule, only one inoculation per person was made, but a second was advised as conferring greater immunity. The method of Haffkine is based upon much the same principle. He first injects beneath the skin a weak virus, in order to establish some degree of tolerance; subsequently he injects a strong virus. The attenuated virus is prepared by growing cultures of the comma-bacillus in a current of air, while the stronger virus is prepared by successive passages of the cultures through a series of guinea-pigs. It will be noted that Haffkine has closely followed the general idea of Pasteur in the preparation and use of a weaker and a stronger virus. Both Ferrán and Haffkine employed their methods as prophylactic. The anti-cholerin of Klebs is likewise a product of cultures of comma-bacilli. It has been employed in the treatment of developed cases of the disease, with results, however, that can scarcely be considered conclusive.

Should time and experience confirm fully the expectations concerning the prophylactic value of the anti-choleraic inoculations, there will have been found at last an effectual mode of grappling with cholera-epidemics, even in India, their habitual starting-point; for it can be applied successfully even in unsanitary surroundings. A slight measure of the value of an effective prophylactic of this nature is suggested by the following incontestable facts: The destructive severity of cholera-epidemics in India is decidedly increasing. During the eight years from 1878 to 1885, inclusive, there were in India upward of 2,000,000 deaths from cholera; during the seven years from 1886

to 1892, inclusive, there were in the same country upward of 3,000,000 deaths from the same disease. This appalling increase of an already frightful mortality due to cholera furnishes the most positive proof that, whatever the official sanitarians connected with the government of India may assert in international sanitary congresses and elsewhere in laudation of the prophylactic measures said to be enforced in India, at great expense, for the limitation of the movements of cholera there, they are utterly incapable of accomplishing the object. In view of the ineradicable influences of caste, and antiquated, abominable domestic customs universally prevalent among the natives of India, one personally familiar with the nearly absolute lack of sanitation among the native populations of Hindustan must be visionary indeed if he can even dream of ever remotely approaching the effectual restriction of cholera-epidemics in that country by means of the mode of general prophylaxis in vogue there in the past and at present.

One thing at least was proved to my mind by the personal investigation of the official statistics of the anti-choleraic inoculations of Ferrán in Spain during the great epidemic of 1885—namely, that time and again not only were thousands of individuals, living amid unsanitary surroundings but little better than those of the villagers of Hindustan, effectively protected by inoculation against the cholera which so cruelly ravaged their uninoculated neighbors, but likewise violent epidemics of cholera in Spanish villages were rapidly cut short by the performance of a general protective inoculation among the inhabitants.

**Therapeutic Treatment.**—*Clinical Divisions.*—For purposes of convenience cholera may be divided into several stages. The first is that of premonitory diarrhea, the so-called "cholerine;"[1] the second is the stage of spasm and rice-water stools; the third is the stage of collapse or the algid stage. Death is the frequent sequel of the latter stage, but if recovery is to ensue, reaction now sets in, and may proceed directly to convalescence; or the reaction may be followed by a fourth stage, designated the "typhoid."

*Precautionary Treatment.*—On the slightest indication of looseness of bowels at a time when cholera prevails, or in a suspicious case, the individual should be carefully segregated, placed at absolute rest in the recumbent posture in a well-ventilated apartment, and restricted to a liquid diet consisting of milk, broths, and the like. Some form of intestinal antiseptic may now be administered, such as beta-naphthol, salol, bismuth salicylate, tribromphenol,

[1] It should be noted that of recent years this term "cholerine" has frequently been misapplied, often grossly abused, for purposes of deliberate deception. Local epidemics of cholera, even in its virulent form, have habitually been reported of late by some European governments, if they have been reported at all, as "cholerine," for the purpose both of lulling the alarm of the local populace and of deceiving their neighbors. This fraudulent practice deserves the severest condemnation. The important fact in this connection should constantly be kept in view that while real "cholerine" is not usually so serious an attack for the patient as is fully developed cholera, it is none the less serious for those who become exposed to the danger of infection, for it should always be borne well in mind that the intestinal contents and the discharges from a true case of "cholerine" contain the infection of *cholera infectiosa*, and are capable of disseminating an epidemic of genuine cholera which may ravage a whole continent.

creosote, iodoform, etc. Beta-naphthol may be administered in doses of from 3 to 5 grains (0.19 to 0.32) three or four times a day; of salol, from 15 to 30 grains (1.–2.) may be given as an initial dose, and repeated every hour for four or five doses, and subsequently in the same or a smaller dose at intervals of three hours; of bismuth salicylate, 10 grains (0.65) may be given from three to five times a day, alone or in conjunction with benzonaphthol, 10 grains (0.65); tribromphenol may be administered in an initial dose of 15 grains (1.), preferably in combination with bismuth, and followed by doses of 7½ grains (0.50) every two hours by day and every three hours by night for a period of from two to five days; iodoform has been recommended in doses of 15 grains (1.) daily. Creolin has also been employed, a couple of dessertspoonfuls of a 2.5 per cent. solution in water being administered every two hours, and a 1 per cent. solution also being injected into the rectum; but the results have not been encouraging. Quinin and its salts have been recommended warmly, in both large and small doses, and administered by the mouth and by subcutaneous injection.

*Curative Treatment.*—For the vomiting that is often present cocain may be administered in doses of from gr. ⅛ to gr. ss (0.0081–0.032) with varying frequency; or chloroform may be given in doses of from 10 to 30 minims (0.62–2.) every one, two, or three hours; champagne may be given, and also cracked ice or creosote or menthol. In cases of obstinate vomiting lavage may succeed when other measures have failed. This procedure has additional usefulness, as the vomited matters often contain virulent cholera-bacilli, and the gastric contents possess toxic properties, and when injected into lower animals induce symptoms resembling those of cholera-intoxication. In irrigating the stomach simple sterilized water may be used, or a solution of boric acid or one of tannic acid.

Should the diarrhea persist for more than a few hours, and an undoubted attack of cholera develop, a dose of from 5 to 10 grains (0.32–0.65) of mercurous chlorid (calomel) should be administered, followed by doses of about gr. ⅙ (0.011) at intervals of about three hours. In the past it has been customary at this stage to recommend the administration of an opiate, but, according to modern views, the evacuation of the infectious and toxic contents of the intestinal tract is an end to be sought and encouraged rather than to be interfered with and checked. The danger resides mostly in the presence of the comma-bacilli and their products, not so much in their extrusion. The therapeutic indications are to remove or destroy the offending cause of the morbid state or to attenuate its virulence, or to neutralize, eliminate, or dilute the poison already present, to restore the fluidity of the blood and the bodily heat, and finally to re-establish the functions of the various secreting and excreting organs. The primary indication is met by the employment of mercurous chlorid in the manner outlined, and the utility of this mode of treatment has been demonstrated by actual experience, both recent and remote.

*Enteroclysis.*—Should the symptoms be not quickly restrained, despite the faithful and intelligent employment of the measures already recommended, the

enteroclysis of Cantani may be instituted. This consists in the injection per rectum into the colon, at a temperature of between 100.4° F. (38° C.) and 104° F. (40° C.), of a solution of tannic acid in water or in infusion of chamomile, and containing a small quantity of tincture of opium. Following is the formula:

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| Tannic acid, | from 5 to 20 grams (gr. lxxv–ʒv); |
| Tincture of opium, | from 30 to 50 drops; |
| Powdered gum arabic, | 50 grams (℥j ʒix); |
| Boiled water or hot infusion of chamomile, | 2 liters (quarts). |

Of this solution a variable quantity—say from a pint to 2 quarts, according to age and other conditions—is employed. The injections are best made immediately after an evacuation of the bowels.

This measure will have the effect of limiting the proliferation of the cholera-bacteria and other micro-organisms present in the bowel, and of neutralizing, at least partly, the poisonous products already generated therein. It may also accomplish, to some extent, the further most important purpose of supplying fluid to the blood thickened from effusion into the intestines of its watery elements, and of providing heat to make good the loss from deficient oxidation and profuse discharge.

Instead of the fluid used by Cantani as detailed, a simple physiologic salt-solution of a temperature between 100.4° and 104° F. (38°–40° C.) may be employed in a similar manner for flushing the colon. To this might also be added one or more of the harmless intestinal disinfectants, in a weak proportion.

*Hypodermoclysis.*—Should the symptoms still not yield, and should the gravity of the case increase and a condition of collapse threaten, there may be employed, in addition, hypodermoclysis, or subcutaneous infusion, which consists in injecting beneath the skin, into the cellular tissue, a solution of sodium chlorid constituted as follows:

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|---|---|
| Pure sodium chlorid, | 8 grams (ʒij); |
| Sodium carbonate, | 6 grams (ʒiss); |
| Boiled water, | 2 liters (quarts). |

Of this solution from 1 to 2 liters at a temperature of from 100.4° to 104° F. (38°–40° C.) are introduced, every two or three hours, by means of a fountain-syringe and a hollow needle, beneath the skin of the thigh or the interscapular region; or, instead, intravenous infusion—that is, the injection into a vein of a physiologic (0.6 per cent.) salt-solution—may be practised. This procedure will supply fluid to the anhydremic blood, make good the loss of heat, dilute the thickened tissue-fluids, stimulate the kidneys to action, and aid in the elimination of the toxic matters circulating in the blood and exercising their baneful effects on the tissues, and particularly on the nervous system.

In addition, should symptoms of collapse supervene, the patient may be

placed in a hot bath, which may be repeated every two or three hours according to circumstances; or he may be treated with the hot pack, or be enveloped in blankets and surrounded by cans or bottles containing hot water. It might also be useful to have the patient placed upon a hot-water bed. These measures will, in addition to supplying heat to the body, act favorably in overcoming any tendency to uremia that may manifest itself. Stimulants will also be needed at this stage; they may take the form of champagne, camphor, musk, ammonia, atropin, strychnin, and the like.

Care must be taken that the bladder be evacuated regularly. The integrity of the kidneys is at best likely to be damaged, and it is important to avoid, if possible, both suppression and retention of urine.

In the algid stage of the disease or when collapse impends, inhalations of oxygen may be employed with at least temporary benefit.

Should the principle of anti-choleraic inoculation become well established as an effective and practical means of prophylaxis, the complementary principle of cure by the employment of a cholera-antitoxin may become more or less feasible. But in the case of cholera the often extreme rapidity of the course of the disease would constitute a serious difficulty which would render impossible the availment of such a treatment, at least for the very rapid attacks.

Should the patient finally enter upon convalescence, he will still require careful watching and attention. Complicating conditions may demand correction, strength will have to be conserved, and nutrition will need to be improved. Again, the local and constitutional conditions in *cholera infectiosa* should be clearly before the mental vision of the physician in charge—namely: (1) An infection of the intestinal tract, frequently associated with more or less damage, sometimes amounting to erosion, of the epithelial surface; (2) systemic intoxication through absorption of the toxic substances developed in the intestinal canal. It must be remembered also that the kidneys are usually more or less injured, at least temporarily. Food must be selected and administered with caution. Both the kidneys and the intestines being in a damaged condition, the vicarious action of the skin must be brought into play, for the relief of all of these organs as far as possible. Moreover, the damage inflicted upon the red corpuscles of the blood during the course of an attack of *cholera infectiosa* should furnish an indication for the administration of proper tonics during and after convalescence.

If the patient at the end of the attack should pass into the typhoid stage instead of simple convalescence, we must again revert to the pathologic conditions for therapeutic guidance. This stage, which is next in danger and fatality to that of algidity, consists essentially in a form of secondary mixed septicemia consequent upon the wounded condition of the mucous membrane of the intestines, and it should be treated chiefly from that point of view, bearing in mind, of course, at the same time, the complications of an associated nephritis, a greatly hampered nutrition, and a toxemia.

**Prognosis.**—The danger of fatality in *cholera infectiosa* varies greatly according to the stage in which vigorous and wise treatment is applied; it

varies also as the form of the epidemic is mild or virulent; and it varies sometimes as to whether the attack is near the beginning or the end of the local epidemic, the general rule being that attacks near the commencement of a fully established epidemic are more likely to be fatal than those occurring toward the end; but this rule has numerous exceptions, the probable explanation being based upon the well-established fact that a certain degree of tolerance of the cholera-poison or immunity against the full consequences of infection is often acquired by those who pretty constantly take into their stomachs smaller doses of the infection than are required to induce an actual attack, and who, when a much larger dose of the infection is taken in, sufficient to induce an attack, find themselves at least partially protected against the full effects of the cholera-poison. This latter peculiarity is often strikingly evidenced by the contrast frequently observed between the very serious attacks in persons recently arrived in the focus of an epidemic which has been long persisting, and the comparatively mild attacks among those who have remained in the focus and have been a long time exposed to the infection; and this contrast also furnishes a proof that the change in the character of such an epidemic from virulent to mild is no evidence that the virulent quality of the infection has correspondingly abated.

The danger of mortality in this disease depends chiefly upon the clinical stage, the gravity of the attack being usually measurable in the following order: the algid stage, or that of collapse; the typhoid stage; the spasmodic or rice-water stage; the stage of premonitory diarrhea; the stage of convalescence. The prognosis in the algid stage is usually desperate; in the typhoid stage, very grave; in that of rice-water discharges, serious; in the premonitory stage, sufficient to warrant anxiety; in the stage of convalescence, trifling. The different conditions expressed in the various stages mentioned are more or less amenable to proper and prompt treatment in the inverse order in which they are named.

NOTE.—The writer desires to acknowledge here the valuable assistance of Dr. Eshner in collecting notes for this paper during the absence of the former while attending the International Sanitary Convention of Paris as a representative of his government. Many of these notes are incorporated in this article, *in extenso*.

# YELLOW FEVER.

By JOHN GUITÉRAS.

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In view of the new fields that have been opened in the treatment of infectious diseases by the discoveries of Koch, Behring, Kitasato, Roux, and others, one may well look with dismay upon our present efforts toward a scientific direction of the treatment of yellow fever. In no other disease has our knowledge of the physiologic action of drugs been more fruitless than in this. In no other disease have we oscillated with greater rapidity in different epochs, or within the short history of a single case, between the extreme limits of depressant and stimulating treatment. These extreme measures have been directed either against general conditions supposed to exist or against special functions that were supposed to be deranged. Bloodletting, general and local, aconite, purgatives, disinfection of the intestinal tract, digitalis, alcohol, iron, food, and starvation have been used with a more or less precise object in view. If the object has been to obtain the prompt relief of some disturbed function, the result has very frequently been unsuccessful. Now, if we fail to obtain promptly the desired physiologic result from the administration of one or very few doses of a therapeutic agent, how much less likely are we to obtain it by frequently repeated dosing! This may bring about a different effect from the drug, or the structural changes induced by the disturbed functions will be found further advanced. The result of this has been that empiricism has more or less dominated the practice of the physician in the treatment of yellow fever.

Those of us who have seen much of the disease believe that they are in the possession of measures that are effective in furthering the tendency toward recovery. Of such measures I shall speak in this paper. The object, however, of these introductory remarks has been to point out new lines of experimentation in the study of the physiologic action of drugs. If the recovery from infectious diseases depends essentially upon the elaboration in the body of substances that counteract the influence of the toxins of the pathogenic bacteria, an inquiry suggests itself as to therapeutic agents that may stimulate the metabolic changes that bring about these favorable results. Who has not been amazed by the picture of a patient after rapid defervescence in a grave infectious disease, such as pneumonia or erysipelas? Twenty-four hours before there were high fever, anxiety, and frequent respiration and pulse. The maintenance of the pulse was perhaps thought to depend upon the large doses of alcohol that the patient was taking. Now everything is changed except the

large doses of the stimulant. The patient stands on an entirely different plane of functional activity, and yet he has continued to take the same enormous doses of stimulant. One might be tempted to suppose that at the same time with the elaboration of the specific antitoxin the patient has succeeded in elaborating also an antitoxin of alcohol. It is, however, more reasonable to suppose that the alcohol in the frequently repeated doses was not acting as a stimulant to the circulation. As we believe that alcohol does influence the course of these cases for the better, it becomes the duty of the therapeutist to examine the action of this drug upon the globulicidal power of the serum and the antitoxin-reaction of the cells. It appears probable that upon this new basis we may find a common stand for such apparently dissimilar forms of treatment as bloodletting and the administration of alcohol.

The most successful results in the treatment of yellow fever are obtained outside the focus of infection. A non-infected hospital gives a better percentage of recoveries than an infected one. An uninfected ship and the tent-hospitals that we have erected in our yellow-fever campaigns, outside of the focus of infection, give us good results. On the other hand, the very worst results are obtained in the military hospital of Havana. The wards of this hospital are large and the ventilation in summer is perfect; but the institution is probably the most intense focus of yellow-fever infection in the world.

Much has been said about the importance of early treatment in the management of yellow fever. I agree fully with this, if we only knew definitely what was to be done to prevent the structural changes that are undoubtedly initiated in this stage. A certain plan of operation is popularly believed to be imperatively demanded. The patient must be given a hot mustard-bath or foot-bath. Blankets must be piled upon him until free perspiration is established, and the bowels must be energetically acted upon. This plan, if the last two measures are not carried to extremes, is justified by the experience of many successful practitioners; but it is not essential. This statement is important. There is a peculiar element of excitability of the emotions in yellow fever. The patient is much disturbed by fear. I have seen patients terror-stricken because they had failed to receive the foregoing treatment. I do not employ it myself when I have the full confidence of the patient and his friends. Much would be gained if it were generally known that such treatment is even condemned by very good authorities. I prefer to place the patient under light covers in a well-ventilated room, and to administer at once a dose of antipyrin or some similar preparation, in capsule, if the initial headache and rachialgia are very severe. This is followed by the administration of a purgative. If the stomach is not over-sensitive, I prefer potassium bitartrate well diluted. If the stomach is irritable at this early stage, I give a Seidlitz powder in broken doses, in ice-water, to mix in the stomach. If the action of the purgative is not obtained or is insufficient, a large enema of cold water should be administered. The patient frequently reports much improvement of the general distress and local symptoms after a free evacuation of the bowels From an examination of the histories of patients coming in the shipping to the quar-

antine station, Surgeon H. R. Carter of the Marine-Hospital Service finds a greater proportion of fatal cases among those who had not received purgative treatment in the initial stages of the disease. A prescription for a solution of ammonium acetate, and the repetition of the laxative, if needed, on the third and perhaps also on the sixth day, may be considered appropriate treatment in cases showing unmistakable evidences of a tendency toward recovery, and this includes the majority. The purgative used in these latter stages should consist of small doses of calomel and compound jalap-powder in capsules:

Take of Calomel, 3 grains (0.19);
Compound jalap-powder, 10 grains (0.65).—Mix.
Two or three doses may be given in a day.

There are two forms of routine treatment that have received the commendation of able practitioners. I refer to general bloodletting and the administration of quinin. The former treatment has been universally abandoned. I have used it in two cases in which the initial symptoms were very severe. I was on board ship, and had no drug on hand except quinin. In these two cases the distressing symptoms were considerably relieved and recovery followed. In 1879, an able practitioner of Havana, Dr. Louis Rey, who had some reputation among foreign seamen as a successful physician in the treatment of yellow fever, still insisted upon bloodletting as an important element of the treatment. I have not ventured, however, to employ this treatment in other cases than those mentioned.

The persistent use of quinin as an antipyretic or antiperiodic is evidently harmful. I have employed, on the morning of the second and third days, two or three doses of 6 grains (0.39) each of quinin, and I am doubtful as to the propriety of having finally abandoned this form of treatment.

The diet should now be considered as part of the routine treatment of the disease. Liquids should be given frequently. If too large a quantity is given at a time, the gastric distress is increased. In some cases cold drinks, in others warm drinks, are most agreeable. Weak orangeade with a little sugar, lemonade, orange-leaf tea, orange-flower water, toast-water, and effervescing drinks are the most acceptable. In the majority of instances most of these liquids are better borne if given warm, especially when alternated with the administration of cracked ice. The latter should be used when the stomach is most irritable.

The diet should be much restricted. Weak broths and diluted milk may be given occasionally by the mouth if they are tolerated. It is but rarely that I insist upon feeding, and use the rectum for this purpose if all food is rejected by the stomach. Weak milk with lime-water is the form of food best supported by the stomach. In the later stages of the disease, especially in cases of long duration, the stomach becomes, as a rule, less irritable. Feeding and stimulation are well borne in such cases. Aromatized alcoholic meat-preparations should then be employed, or combinations of milk, egg, and alcohol.

When the tendency to recovery is well established, soft-boiled eggs and soups should be given for one or two days, and a more solid diet need not be long delayed. The return to the normal condition is perhaps more rapid in yellow fever than in any other severe infectious disease.

**Special Indications for Treatment.**—*Stimulants.*—Alcohol is of great advantage in prolonged cases of yellow fever. Usually its employment is beneficial after the fourth or fifth day of the disease, unless convalescence be well established by that time. We never find, as in pneumonia, typhoid, and erysipelas, any advantage in administering large doses of alcohol; but the administration of wines, such as Madeira with effervescing water, or whisky diluted in the same way, or champagne, is comforting to the patient and undoubtedly beneficial.

*Cephalalgia, Rachialgia, and Delirium.*—As said before, the intense pains, frequently indicative of the severity of the attack, are best relieved by antipyrin or phenacetin. These drugs should be given cautiously, and never repeated unnecessarily or with a view to lower the temperature persistently. In severe cases the tendency to stasis and to hemorrhages is, in my opinion, increased by the frequent use of such drugs. The same may be said of the use of morphin. Relief is sometimes secured by the use of laxatives or of enemata, also by the use of camphor-liniments and cooling applications to the head. The use of sedative water is especially to be recommended for this purpose. This preparation consists of—

| | |
|---|---|
| Spirit of camphor, | 1 part; |
| Water of ammonia, | |
| Common salt, | of each, 6 parts; |
| Water, | 100 parts. |

The delirium is to be treated in recoverable cases by alcohol, caffein, or compound tincture of cinchona. There are, however, rapidly fatal cases with early manifestations of stasis, early jaundice, and black vomit, accompanied by violent delirium. These cases are hopeless. In them I would recommend, as a palliative measure, the use of hypodermic injections of hyoscin.

*Vomiting, Epigastric Distress, and Belching.*—In the majority of instances requiring special attention in these directions relief will be obtained by the use of lime-water and milk, ice, effervescing mixtures, and above all by the use of small doses of calomel frequently repeated. Warm aromatic poultices should be applied to the epigastrium. Some patients find cold-water compresses more soothing. The sedative water may be employed for this purpose. Tablets of $\frac{1}{4}$ or $\frac{1}{2}$ of a grain (0.016—0.032) of cocain were very generally employed in the last epidemic at Brunswick. For my part, I prefer in severe cases, after giving fractional doses of calomel during twelve hours, to begin the administration of the tincture of ferric chlorid, 10 or 15 drops every three or two hours. This allays somewhat the distress. It will sometimes be found to stop the black vomit, and it appears to me to exert a favorable influence upon the

course of the disease. In my practice most of the severe cases are placed upon this treatment about the fourth day of the disease. They receive nothing else, except alcohol and food as previously recommended, and laxative doses of compound jalap-powder, if needed, in order to ensure one passage every day.

*Suppression of Urine.*—This grave complication is to a certain degree averted by the foregoing treatment. If suppression presents itself, I believe the most powerful remedy we have to combat it is calomel. Further, I diminish the amount of alcohol that is being given, substitute tincture of digitalis for the iron if the stomach will bear it, and give 3 grains (0.19) of calomel every six hours. Two or three doses will bring about the desired effect. If they fail, I would not push the treatment any further.

*Fever.*—I have tried cold in the treatment of yellow fever, and believe it to be harmful. A special form of apparatus, the so-called "polar chamber," has recently been devised in Cuba for the treatment of this disease. The result has not been favorable. I have already expressed my opposition to the continued use of antipyretics. Perhaps it does no harm, and certainly some temporary comfort is given the patient, by administering a dose of phenacetin or of antipyrin when the temperature rises above 104° F. (40° C.), but I should not continue to administer it in the face of recurring manifestations of hyperpyrexia. In such cases I should give 3 grains (0.19) of calomel and 6 grains (0.39) of compound jalap-powder, in capsule, to obtain a laxative effect, and should continue the compound jalap-powder alone if the bowels are costive, without, however, forcing active purgation. The arms and the neck should be moistened with aromatic vinegar, alcohol, and water, to which I frequently add the juice of a lemon.

*Typhoid Cases.*—Finally, there is a group of cases in which there is marked depression, continuing beyond the usual limits of the disease. The pulse is very slow; the skin is clammy; there may or may not be some fever; the urine is loaded with albumin; the jaundice is usually well marked. Such cases are not benefited by increasing the doses of alcohol. They are best treated by Huxham's tincture of bark and potassium chlorate internally. Externally, sponging of the surface with chlorin-water will be found advantageous.

The systematic effort to disinfect the intestinal tract has of late become a popular form of treatment in yellow fever. The method proposed consists in the administration of evacuants first, to be followed by the continuous use of antiseptics. Of these I have only used mercuric chlorid and my results were not satisfactory.

The immunity conferred by a previous attack of yellow fever is so complete, and it is so easy to find in yellow-fever centers individuals who enjoy this immunity, that the treatment of the disease by the use of blood-serum from such individuals has naturally suggested itself to those familiar with the facts. I am not aware that the suggestion has been tested practically.

**Prophylaxis.**—Experience does not warrant the recommendation of any individual precautions against yellow fever except removal from the focus of

infection. Those who must remain may follow with some advantage the very popular advice of sleeping in the country, outside the infected area. The relative immunity enjoyed under these circumstances is not due to the greater virulence of the night-air, but is simply the result of shorter exposure and consequent diminished chance of infection. That individuals who adhere closely to this advice do contract the disease is a fact; and what is worse, they have not rarely been the means of conveying the disease to families living in security outside the infected area.

**Public Measures of Prophylaxis.**—After a careful study of the seaports of our Southern States, I am able to state positively that yellow fever is not at the present time endemic in the United States. This statement does not mean that the conditions favorable to endemicity do not exist. The disease has been endemic in some of our seaports, such as Charleston, Key West, and New Orleans—that is, the disease has broken out at these ports without a fresh importation. It withstood the action of the winter climate, and broke out upon the advent of the warm season. This has occurred more frequently in our Southern cities than is generally believed.

Infrequency of transplantation of this exotic to our soil in recent years has led to its dying out. A case or cases of yellow fever occurring during the summer would of necessity imply a fresh importation of the disease. Our system of defences against such importation, though weakened occasionally by the necessities imposed by commerce, has been very generally successful. The failures to be recorded of late have been found in young and growing cities. Here we meet with a new population untaught by the salutary disasters of previous epidemics, and straining every effort in the competition for commercial advantages. These have not been unclean cities; on the contrary, they compare favorably in this respect with some of the older cities that have escaped, in the same period of time, similar visitations. They were cities where the disregard of quarantine regulations was coupled with frequent intercourse with the foci of infection in our American Mediterranean Sea.

Our quarantine system insists upon a very careful observation and disinfection of ships coming from infected and suspected ports. This system is enforced during the summer months along our coast, from the southern boundary of Maryland to the Mexican coast. The system is maintained in part by the several States, subject to inspection and under rules and regulations established by the United States Marine-Hospital Service, under an Act of Congress approved February 15, 1893. In some seaports, where the State or municipal authorities are not able to maintain these rules and regulations, the officers of the United States have taken charge of the local quarantine. Besides this, we have a number of national quarantine stations upon our seacoast islands at convenient distances from our principal ports. Thus, there is one at Sapelo, on the coast of Georgia, for the South Atlantic coast; one at Dry Tortugas and one at Ship Island, for Florida and the Gulf of Mexico. All evidently infected ships are sent for disinfection and for treatment of the sick to these stations. The ports of Charleston and Savannah and the Boards of

Health of Florida, Pensacola, Mobile, and New Orleans maintain also excellent quarantine plants. Much credit is due them for the high standard of perfection they have striven to establish, and more especially to the city of New Orleans, which has been a pioneer in these matters.

These defences have been strained at a few points in the interest of commerce. In the first place, the large ports north of the southern boundary of Maryland, trusting to the long periods of immunity enjoyed, are to a great extent excluded from the provisions of these regulations. In the second place, we find that within the quarantine zone certain ships are in a measure exempted from the action of these laws as regards detention and disinfection. The ships in question are fruiters and passenger steamers. They are, it is true, subjected to very strict special regulations. The passenger steamers are required, above all, to have an immune crew and to bring only immune passengers. The baggage must be disinfected thoroughly. The fruiters also must have an immune crew. After inspection on arrival in our ports they are allowed to proceed to their docks and to discharge their cargo. It seems to me that a further safeguard may be introduced here without detaining the vessel. I would prefer to see the dunnage and clothing of the crew detained at the quarantine station for disinfection, and forwarded on the following day to the steamer at her dock. The same rule should be enforced with all vessels from infected ports that are allowed a free *pratique* in the port of Baltimore.

Smuggling, especially along the Florida coast, and defective enforcement of the quarantine laws in smaller ports, are obvious flaws in our system of defences.

When a break does take place, it is, unfortunately, not always recognized. I believe that the great source of danger here is to be found in mild cases of the disease that are not correctly diagnosticated. This applies especially to that class of the population frequently employed in discharging ships. I refer to the negro. He enjoys a marked immunity to yellow fever—not that he is entirely insusceptible to it, but that the disease assumes in him a mild form. Such cases are not easily to be recognized as yellow fever, and may become unsuspected sources of infection. Whatever the conclusions may be, I wish to dwell upon the fact that the so-called "first case" in epidemics of yellow fever can be proved in several instances not to have really been the first case. Isolated cases of the disease may occur without giving rise to epidemic outbreaks, but the danger lies in trusting to this fortunate accident. I know of very few instances in which the measures of prevention against the further spread of the disease were not undertaken too late. In our last two epidemics—at Jacksonville and at Brunswick—such measures were certainly directed against cases that were not the initial cases. These first cases may be found in some epidemics to have occurred early in the spring, or even in the preceding summer.

Instead of a policy of repression we ought to have in our Southern cities a free discussion of yellow-fever topics precisely in those seasons of the year when the subject is likely to receive the desired attention. All restrictions upon the report of suspicious cases should be removed. Then we would not look upon underhand rumors as serious affairs. We would do away with that

unfortunate state of excitement that almost precludes the possibility of a careful investigation, and we would not have those wild measures of quarantine instituted by sister cities almost on the mere mention of the word "fever."

*Measures to be Enforced for the Prevention of the Spread of Yellow Fever.*—In the first place, a suspected city should make every effort to have a house-to-house inspection by competent physicians. When the disease is found to exist in a community, the following regulations, instituted by the United States Marine-Hospital Service, should be enforced:

"1. Localities infected with yellow fever, and localities contiguous thereto, should be depopulated as rapidly as possible, so far as the same can be safely done, persons from non-infected localities, and who have not been exposed to infection, being allowed to leave without detention. Those who have been exposed or who come from infected localities shall be required to undergo a a period of detention and observation of ten days from the date of last exposure, in a camp of probation or other designated place.

"Clothing and other articles capable of conveying infection shall not be transported to non-infected localities without disinfection.

"2. Persons who have been exposed may be permitted to proceed without detention to localities incapable of becoming infected and whose authorities are willing to receive them, and after arrangements have been perfected, to the satisfaction of the proper health-officer, for their detention in said localities for a period of ten days.

"3. The suspected persons who are isolated shall be kept free from all possibility of infection.

"4. So far as possible, the sick should be removed to a central location for treatment.

"5. Buildings in which yellow fever has occurred, and localities believed to be infected with said disease, must be disinfected as thoroughly as possible.

"6. As soon as the disease has become epidemic, the railroad trains carrying persons allowed to depart from a city or place infected with yellow fever shall be under medical supervision.

"7. Common carriers from the infected districts, or believed to be carrying persons and effects capable of conveying infection, shall be subject to sanitary inspection, and such persons and effects shall not be allowed to proceed, except as provided for by paragraph 2.

"8. At the close of an epidemic the houses where sickness has occurred, and the contents of the same, and houses and contents that are presumably infected, shall be disinfected."

These measures deserve the highest commendation; for their prompt and effective execution the United States Marine-Hospital Service should be able to mobilize at once a corps of officers, guards, and nurses, with the necessary appliances, such as special trains, barracks, tents, portable disinfecting apparatus, etc. Such a standing army would prove economical, and would be quite in keeping with our peace-loving civilization.

# LEPROSY.

By BEAVEN RAKE.

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Leprosy is a disease that must be regarded as incurable by any means at present known. The following remarks therefore refer to palliative treatment. This may conveniently be considered under three heads: 1. Hygienic; 2. Medicinal; 3. Surgical.

**Hygienic.**—The amount of hygienic treatment possible in leprosy varies according to the circumstances of each individual case. If the patient can afford it, I have sometimes found it beneficial to send him from the tropics to a temperate climate where leprosy is not endemic. This change of climate is more likely to be followed by good results if the patient is sent away at an early stage of the disease. Temporary arrest of progress, and even diminution of tubercles, may sometimes follow this step.

For those who have not the means or the inclination to leave their homes the ordinary rules of health are applicable. The leper must eat only fresh and nourishing food. Fresh beef or mutton and plenty of fruit and vegetables should form the staple diet. Salt fish and tinned or salted food of any kind are to be prohibited. Indeed, all fish should be avoided unless just out of the water. The patient ought to take as much out-door exercise as possible, for thus not only is the nutrition of the body improved, but the mind is occupied and the leper is to some extent prevented from brooding on his condition. Gardening is the most suitable occupation, as it does not involve communication with the rest of the world. Horse-exercise, such as is involved in riding about farms or plantations, is useful in the early stages of the disease, as it induces free perspiration. Some of my private patients derive much benefit from riding. Sea-bathing and subsequent friction with rough towels when possible are to be encouraged. The patient must be warmly clad, for lepers are very sensitive to cold, and often suffer from various forms of renal disease. His dwelling-rooms and sleeping-rooms, however, should be lofty and well ventilated, for the lungs of lepers are very liable to become infected with tuberculosis.

The question of preventive treatment may be briefly alluded to here. Many believe that leprosy has been stamped out in the past, and could be stamped out again, by strict segregation of all suffering from the disease. Though the possibility of inoculation of the disease may be admitted in very rare instances, the available evidence goes to show that the risk of dissemination of leprosy in this way is practically insignificant. The extinction

of endemic leprosy in some parts of Europe has probably been due to improved sanitary conditions, and the recent decrease in Norway has been quite independent of compulsory isolation. It is probable that the further developed hygiene of the future will do more to lessen the spread of leprosy than any compulsory separation of the afflicted. Nevertheless, lepers should be encouraged to enter asylums, both for their own comfort and for the more efficient treatment of the disease.

**Medicinal.**—Many drugs have been used in the treatment of leprosy, and the results obtained have been variously described. Space will only allow a notice here of some of the medicines that have attracted more attention or that have really seemed of value.

Mention may first be made of four vegetable oils that have enjoyed a considerable reputation in leprosy. They are Cashew-nut oil, obtained from *Anacardium occidentale;* Gurjun-oil or Kaurjin-oil, from *Dipterocarpus turbinatus;* Chaulmoogra-oil, from *Gynocardia odorata;* Kauti-oil, from *Hydnocarpus Wightiana.* Cashew-nut oil played an important part in the plan of treatment devised by Beauperthuy at Cumana in Venezuela. He ordered that the entire skin of the leper be rubbed twice a day with cocoanut-oil or olive-oil. After each rubbing the skin was well washed with soap and water. Oil of cashew was then applied to the diseased parts with a sponge. The exudation was allowed to dry on the skin, so as to form a crust. After about twelve days the crusts fell off, leaving the skin beneath clear and free from ulceration. While this local treatment was being pursued the patient had plenty of pure air and nourishing food, including fresh meat and vegetables. Fish and salt meat were forbidden. Mercuric chlorid or sodium carbonate was given internally.

Bakewell, who was sent officially from Trinidad to examine Beauperthuy's cases, reported very favorably on the results obtained. In the course of time, however, fresh crops of tubercles or anesthetic patches made their appearance, and the condition of the patients became as bad as, or worse than, before they were treated.[1]

There is no doubt that the Beauperthuy treatment is distinctly palliative. It involves a strict dietary on the part of the patient, and constant attention to the functions of the skin is ensured by the frequent baths and frictions. The oil of cashew is, however, merely a caustic, and removal of leprous nodules can be less laboriously obtained by free excision of tubercles, as will be shown presently.

The medicines given internally by Beauperthuy had apparently little or nothing to do with the results obtained, for Bakewell found that a patient taking sodium carbonate progressed quite as favorably as one taking mercuric chlorid.

Gurjun-oil was first recommended for leprosy by Surgeon-Major Dougall[2] at Port Blair, Andaman Islands. He directed that two emulsions should be

[1] Hillis: *Leprosy in British Guiana,* p. 212.

[2] *Report on the Treatment of Leprosy with Gurjun-oil,* Calcutta, 1875, p. 6.

made. The first was to be taken internally, and consisted of 3 parts of lime-water and 1 part of gurjun-oil. The second emulsion was for external use, and contained equal parts of gurjun-oil and lime-water. The lepers bathed every morning at daybreak, rubbing off the previous day's inunction with dry earth. Half an ounce of the first emulsion, containing 60 drops of the oil, was then administered to each leper, and the second emulsion was rubbed in for two hours. The same dose and friction were repeated in the afternoon.

Dougall tried this treatment on twenty-five lepers, and at the end of six months reported an arrest of the disease and a great improvement in the general condition. Further experience, however, has not confirmed the hopes raised by these results. It may be that subsequent observers have not fully carried out the details of the treatment. It is obvious that patients under prison discipline, like those at Port Blair, can be treated far more efficiently than those who voluntarily submit to treatment and who soon give up hope of relief.

The Leprosy Commission[1], when in India, received answers from forty-eight stations in which gurjun-oil had been used for leprosy. Thirty-four of these stations reported that more or less relief had been obtained, but no cure was mentioned. In some cases the relief afforded was very slight.

Hillis,[2] at the Mahaica Leper Asylum, found that in suitable cases leprosy could be arrested by gurjun-oil, and that in a few instances there was no return of the disease for over two years.

In the Trinidad Asylum[3] I have noticed, after the use of gurjun-oil, only such temporary relief as would follow friction with cocoanut-oil or any other simple application.

Vandyke Carter[4] also used the oil internally and externally for months without obtaining any perceptible improvement.

Radcliffe Crocker[5] found that English patients could not take more than 60 drops a day, and that only by raising the dose gradually from 5 drops.

Chaulmoogra-oil has long been known in the East as a remedy for leprosy. Like gurjun-oil, it is used both internally and externally.

Vandyke Carter[6] obtained decidedly good results after the use of the oil in young, fairly nourished subjects early in the disease. These results were far less marked, or were altogether absent, in more advanced cases. He found that the longer the oil was used the more favorable was the result, both in degree and in permanence. The good effects lasted for as long as five years after prolonged use of the oil, but the disease was never eradicated.

The Leprosy Commission[7] received answers from thirty-six stations in which chaulmoogra-oil had been used. Twenty-five reported more or less relief after the use of the oil. In some cases the relief was very slight; in others the disease was said to be arrested.

[1] *Report of the Leprosy Commission in India.* [2] *Op. cit.*, p. 224.
[3] *Report on the Trinidad Leper Asylum for* 1884. [4] *Reports on Leprosy*, second series, 1876, p. 36.
[5] *Diseases of the Skin*, 1888, p. 477. [6] *Op. cit.*, p. 34. [7] *Op. cit.*

Philippo[1] of Jamaica records a case in which the patient lived in grease for over five years, chaulmoogra-oil being given internally, while gurjun-oil was rubbed into the skin. At the end of that time the leprosy was completely arrested, though there were marks of the old disease. Five years afterward there had been no return.

In the Trinidad Asylum many of the more intelligent patients ask me of their own accord to give them chaulmoogra-oil, and persevere in its use. One man used the oil internally and externally for seven years. The leprous nodules disappeared from the skin and anesthesia was lessened.

The chief results that I noticed in eighteen cases[2] were—(1) Increase of perspiration; (2) decrease of tubercles; (3) improved appetite and sense of well-being; (4) increase of sensation; (5) increased suppleness of skin and lessening of pains in the joints. In a private patient who had taken capsules of chaulmoogra-oil for six years, and who had also tried residence in Europe, there was a great diminution of tubercles and the intervals between the outbreaks were much lengthened. At one time he was taking 75 drops a day.

The fact that these lepers persevered in the treatment is strong presumptive evidence that they derived benefit from chaulmoogra-oil, for, as has been pointed out, such patients soon tire of systematic medication.

Chaulmoogra-oil may be given floating on milk or coffee or in capsules or pearls. It is best to begin with a dose of 10 drops two or three times a day. This dose may gradually be increased according to the endurance of the patient. Though the tolerance of this oil is greater than that of gurjun, it is seldom that the patient can take more than 60 drops a day. Nausea, vomiting, and diarrhea ensue if too much is given. To avoid these complications gynocardic acid, the active principle of the oil, has been recommended in doses beginning at $\frac{1}{2}$ grain (0.032) and gradually increasing up to 3 grains (0.19) three times a day.

Kauti-oil was used in the treatment originated in Bombay by Bhan Daji more than twenty years ago. He ordered from 10 drops to $\frac{1}{2}$ ounce (15.) of the oil to be taken in the early morning on boiled milk. Then the patient was rubbed all over with the oil. After two hours this was washed off in a warm bath. Sometimes the oil was applied again and kept on till evening, when the patient wiped himself and went for a walk till he perspired. In other cases the second application was made in the evening, and the patient slept in the oil. It was applied also to affected mucous surfaces.

Stanley Boyd[3] has recently published nineteen of Bhan Daji's cases. In some of these cases marked improvement is noted. Swellings subsided, redness became less, tubercles softened, and ulcers healed. Vandyke Carter, however, who was living in Bombay at the time, was not encouraged by the results obtained from a trial of Kauti-oil.

From a consideration of the methods of using the oils named, it is evident

[1] *Epidemiological Society's Transactions*, 1890.
[2] *Report on the Trinidad Leper Asylum*, 1889.
[3] *British Journal of Dermatology*, July, 1893.

that friction and stimulation of the functions of the skin form such an essential part of the treatment that it may fairly be doubted whether the oils themselves have any specific action. It is probable that a certain amount of relief may be obtained from the use of a perfectly simple oil, provided it is rubbed in regularly and thoroughly, and the patient is well fed and leads an active life meanwhile. In the Trinidad Asylum cocoanut-oil is largely used to rub the skin, the patients being encouraged to bathe in the sea and to work in their gardens as already mentioned. Others seem to get more relief from oil of cade or from camphor-liniment.

Arsenic has been much used in the treatment of leprosy, and sometimes with encouraging results. Bowerbank[1] of Jamaica and Nicholson[2] of Antigua found that this drug arrested the disease for a time.

In the Trinidad Asylum[3] I gave arsenic during several months to two lepers who were particularly subject to frequent acute outbreaks of tubercles. One patient was a German, the other a slightly colored Barbadian. Both had very delicate skins, and were therefore excellent subjects for testing the value of treatment. The result observed after the prolonged use of arsenic was a very marked diminution in the frequency of the characteristic febrile and nodular exacerbations. The German was without an attack for almost a year, whereas before he began taking arsenic the eruptions had occurred at intervals of a few weeks.

Arsenic is best administered in the form of liquor arsenicalis (B. P.): 3 or 4 drops should be given three times a day after meals, and the dose should gradually be increased till nausea or other symptoms of overdose show that the patient's limit of toleration has been reached.

About eight years ago, Unna[4] of Hamburg recommended ichthyol and resorcin in the treatment of leprosy. He used them both internally and externally, and described them as reducing agents which withdraw oxygen from the epidermis, causing cornification and subsequent exfoliation, with relief of inflammation and edema. These drugs have since been issued by the Indian government for trial in the various stations, but little or no benefit has been derived from their use. In the Trinidad Asylum[5] I noticed that eczema and other cutaneous complications of leprosy improved rapidly after the use of ichthyol, but the same results can be obtained by the employment of a simple application, such as vaselin.

Lutz[6] in Hawaii treated lepers with salol and sodium salicylate internally and chrysarobin and pyrogallic acid externally, and reported that the disease was arrested. Radcliffe Crocker,[7] on the other hand, observed no relief at all from the use of chrysarobin.

At the request of the Leprosy Commission, Surgeon-Major Cook[8] treated

[1] *Royal College of Physicians' Report on Leprosy*, 1867, p. 14. [2] *Ibid.*, p. 21.
[3] *Report on Trinidad Leper Asylum*, 1884. [4] *Dermatologische Studien*, ii., Hamburg, 1886.
[5] *Report on Trinidad Leper Asylum*, 1886.
[6] *Biennial Report of President of Board of Health*, Honolulu, 1890.
[7] *Op. cit.*, p. 477. [8] *Op. cit.*

with salol a number of patients in the Madras Leper Asylum. He reported that the drug did no good. In the Trinidad Asylum I have found salol and salicylic acid useful to relieve the pains in the joints so common in leprosy, but the disease itself has been unaffected.

More recently, Goldschmidt[1] of Madeira reported favorably on the effect of europhen in leprosy. In Trinidad I have failed to confirm his results.

Carreau[2] of Guadeloupe gave a leper 45 grams, or about 675 grains, of potassium chlorate in three days. The result was bilious vomiting, diarrhea, prostration, and a sudden attack of syncope. Spectroscopic examination of the blood gave a band of methemoglobin. Photographs taken before and after treatment showed a remarkable difference. The tubercles almost disappeared from the face and the extremities, and sensation was partially restored.

Two patients in the Trinidad Asylum[3] were ordered from 80 to 100 grains (5.2–6.5) of the chlorate a day, and this treatment was continued for several weeks. The cutaneous nodules became perhaps slightly smaller and ulcers began to heal, but nothing like the effect described by Carreau was observed. It will be noted that the doses were much smaller, and only very slight toxic effects were produced. In two other patients who took smaller doses of the chlorate, leprous ulcers also began to heal. Lessening of cutaneous nodules and healing of ulcers can, however, be promoted by free purgation with magnesium-salts.

It was hoped that Koch's tuberculin would prove useful in leprosy, but, as in the case of tuberculosis, these hopes have not been fulfilled. Surgeon-Major Cook,[4] who conducted experiments on twelve selected lepers in the Madras Asylum, reported to the Leprosy Commission that tuberculin was an absolute failure. A rise of temperature followed the injections, but the tubercles were unaffected. On the other hand, Poupinel de Valence[5] in Mauritius has published photographs showing a diminution of tubercles in two out of five cases subjected to this treatment. He recommends, however, that the tuberculin-treatment should be supplemented by the use of chaulmoogra-oil.

In the Trinidad Asylum[6] I have lately been treating five lepers with tabloids of extract of thyroid gland, but I have noticed no effect on the nodules, though one or two of the patients have complained of the characteristic breathlessness and oppression that occur in the course of thyroid-feeding.

Many diseases have been described as retarding the progress of leprosy. Danielssen and Boeck[7] record the disappearance of cutaneous nodules after an attack of small-pox. Leloir[8] describes erysipelas and pulmonary tuberculosis as producing a like result, and I have noticed a similar phenomenon in Trinidad. The absorption of cutaneous tubercles is especially marked when the patient develops pulmonary tuberculosis. Sometimes also after vaccinating a leper I

[1] *Les Nouveaux Remèdes*, 1893.
[2] *Contribution au Traitement de la Lèpre*, 1892.
[3] *Report on Trinidad Leper Asylum*, 1892.
[4] *Op. cit.*
[5] *Experiments with Koch's Tuberculin*, 1891.
[6] *Report on Trinidad Leper Asylum*, 1893.
[7] *Traité de la Spedalskhed*, p. 324.
[8] *Traité pratique et théorique de la Lèpre*, p. 224.

have observed an initial swelling of the skin, followed by a marked lessening of leprous nodules and infiltration.

These clinical observations naturally suggest a rational treatment of leprosy by antagonistic inoculations. This I have attempted by injecting cultures of micrococcus pyogenes[1] into leprous nodules. These injections were usually followed by temporary pyrexia, swelling, and redness, and sometimes by local suppuration and destruction of leprous tissue, but no general or permanent effect ensued. This treatment, however, has possibilities of further development.

It is only necessary to allude very briefly to such drugs as ferric chlorid, potassium iodid, and cod-liver oil. They are often useful adjuncts in the treatment of leprosy, but their action is exactly the same as in other diseases. Mercury may be given if the leper is suffering from syphilis. The latter disease is rapidly influenced, while the leprosy remains unchanged. Some writers are afraid to give mercury in leprosy, but this fear is groundless.

From the foregoing considerations it appears that chaulmoogra-oil and arsenic are the most valuable drugs at present known in the palliative treatment of leprosy. It must, however, always be remembered that under suitable hygienic conditions, or even without them, spontaneous arrest of the disease may sometimes take place when no medicines are given. It is therefore difficult to estimate the part contributed by drugs to any improvement in the condition of the patient that may follow their use.

**Surgical.**—It would be out of place in a medical work to do more than refer very briefly to the surgical treatment of leprosy. Much relief may be given by operative interference, and it is remarkable how rapidly the tissues of lepers heal after operation. This may be due to an excess of fibrin in the blood, which has been shown to exist by Danielssen and Boeck,[2] Hillairet,[3] and myself.[4]

Nerve-stretching has been practised in leprosy by Lawrie,[5] Downes,[6] Neve,[7] Mitra,[8] and others. In the Trinidad Asylum[9] I have done the operation one hundred and thirteen times on various nerves. More or less relief was obtained in about half the cases. The chief results noticed were relief of pain in the course of the nerves operated on, healing of perforating ulcers in the areas supplied by these nerves, and, more rarely, some decrease of anesthesia. Relief was, however, transient, and the operation had sometimes to be repeated on the same nerve. Nerve-stretching is especially valuable in the treatment of the distressing neuralgia that often complicates leprosy.

Kenneth Macleod,[10] who combined longitudinal splitting of the nerve with stretching, has recorded considerable relief in six out of eight cases.

[1] *Report on Trinidad Leper Asylum*, 1889.
[2] *Op. cit.*, pp. 238, 296.
[3] *Ann. de Dermat. et Syphilig.*, tome v. No 3.
[4] *Lancet*, Jan. 9, 1892, p. 83.
[5] Heath's *Dictionary of Surgery.*
[6] *Medical Society of London*, May 20, 1886.
[7] *Medical Record*, vol. i., Nov., 1890, p. 269.
[8] *Internat. Journ. of Med. Sciences*, July, 1891.
[9] *St. Louis Med. and Surg. Journal*, April, 1893.
[10] *Royal Medical and Chirurgical Society*, Feb. 13, 1894.

In the Trinidad Asylum[1] I have freely excised cutaneous nodules and then applied strong nitric or carbolic acid. This procedure is followed by firm cicatrization and is far less tedious than that recommended by Beauperthuy. Recurrence, however, occurs around the cicatrices within a year or two. Patients sometimes ask for excision of tubercles from the face, with a view to cosmetic effect.

Leprosy is often complicated with painful perforating ulcers of the feet. It has already been pointed out that such ulcers often heal when the nerves supplying them have been stretched, but I find that they can be treated most effectually by passing a bistoury through to the dorsum of the foot and dividing all the tissues forward, the knife being brought out between the toes.[2] The slit thus made is stuffed with lint and left to granulate from the bottom.

The sinuses so common in leprosy require early and free incision down to the bone. The relief afforded by this treatment is appreciated by the patients, who eagerly beg to be operated on. Since I instituted this procedure I have noticed a very marked diminution of gangrene in the Trinidad Asylum. When the latter complication occurs, amputation of the limb will often save life.

The extremities of lepers frequently become hide-bound from effusion or from leprous deposit. Such conditions can be relieved by longitudinal incisions, a foot or more in length, extending down to the subcutaneous tissue.

When the larynx is invaded by the leprous process, dyspnea supervenes and tracheotomy becomes necessary. Life may sometimes be prolonged for years in this way.

The ophthalmic complications so common in leprosy must be treated according to the requirements of each case. When tubercles invade the cornea, an attempt may be made to excise them, or their growth may sometimes be arrested for a time by ligature of the vessels supplying them. If these measures are found useless, iridectomy will in some cases temporarily avert total blindness.

For paralytic ectropion, a common affection in anesthetic leprosy, Kaurin records good results from the practice of tarsorrhaphy. Operations on the eyes of lepers are, however, usually disappointing, the lesions progressing steadily notwithstanding all efforts to arrest them.

Other surgical complications arising in leprosy may be treated in exactly the same way as they would be in those who are not lepers. From what has already been said it will be evident that leprosy is no obstacle to operative interference.

[1] *British Medical Journal*, June 9, 1888, p. 1214.

[2] *Ibid.*, Nov. 8, 1890, p. 1059.

# ANTHRAX.

By JOHN CHALMERS DaCOSTA.

THE cause of anthrax was determined years before the cause of any other infectious malady was known. The disease is one that tends especially to occur in sheep, cattle, and horses; it is unusual in England and the United States, but it is not uncommon in France, Germany, Russia, and the East. Its time of greatest prevalence is in the heat of summer, the cold of winter seeming to prevent the development of the germ. Animals that graze may acquire the disease through the introduction of the causative organisms into the intestinal tract with the food, or by the inoculation of abrasions of the face, the lips, or the mucous membrane of the mouth. Guinea-pigs and mice can become infected by the inhalation of spores.

Man acquires anthrax from diseased lower animals; hence those are liable to infection who have to deal with cattle, sheep, or horses, or who handle the skins and hair of dead animals—farmers, wool-sorters, rag-sorters, paper-makers, workers in hair, tanners, butchers, shepherds, and veterinarians. Every person is more or less exposed to danger from eating diseased meat or butter or from drinking infected milk. Contaminated catgut ligatures may infect a wound. A nurse or a physician may contract anthrax from a patient, as there is danger from contact with the bed-clothing and the dressings. Flies occasionally disseminate the disease. The bodies of animals dead of anthrax should be burned. As certain animals afford a favorable soil for the development of the bacillus anthracis, to destroy the liability of these animals is to stamp out the disease. The aim is by artificial means to make these animals as immune to anthrax as nature has made immune the pig, the rat, the dog, and the bird. Many different methods have been employed, but no one of them is completely satisfactory. Pasteur has endeavored to induce immunity in cattle by injections of attenuated cultures of the bacilli. The cultures are attenuated by growing for twenty-four days at a temperature of 42° C. (107.6° F.). These preventive inoculations are often successful, but they are not entirely reliable.

Hankin[1] makes a culture of anthrax-bacilli, precipitates with absolute alcohol, washes the precipitate to eliminate ptomains, adds alcohol, filters again, redissolves, and filters through a Chamberland filter. The solution thus made contains an albumose, the injection of which into rabbits seems to confer immunity.

[1] *British Medical Journal*, Oct. 12, 1889.

Wooldridge endeavors to confer immunity by injecting animals with fibrinogen on which the bacilli were grown and from which the organisms have been separated by filtration.

It has been suggested that preventive inoculations can be made with a substance extracted from the organs of an immune animal, as the rat.

Certain organisms when injected are antagonistic to anthrax-bacilli. Among these organisms may be mentioned the streptococcus of erysipelas, the pneumococcus, the micrococcus prodigiosus, and the bacillus pyocyaneus. This last-named organism will cure incipient anthrax in animals (Bouchard). Antagonistic organisms themselves, unfortunately, may produce serious illness or even death.

Man may acquire anthrax by the inoculation of a wound or an abrasion, by the introduction into the intestines of contaminated food, or by inhalation. The first form is by far the commonest, and is the only variety that affords a chance of cure.

Because of the high infective power of anthrax, patients should be isolated in a well-ventilated room. All dressings are to be burnt, all discharges antisept« ised, and the bed-clothing, after removal, is to be sterilized thoroughly. After the recovery or death of the patient the room and its contents should be disinfected. Nurses and physicians must exercise great caution, and any wound or abrasion must be excised and cauterized.

In cutaneous anthrax a malignant pustule forms in from three to six days after inoculation. After the lapse of about forty-eight hours from the time the pustule begins to form organisms appear in the blood, and during these forty-eight hours active measures must be instituted to prevent a local infection becoming a general disease. At once the entire inflamed area should be excised, and the resulting wound should be cauterized with pure carbolic acid, pure nitric acid, zinc chlorid of a strength of 1 : 8, or by means of a Paquelin cautery. Excision of the pustule is practised even if glandular implication is obvious, but it proves a useless expedient when bacilli appear in the blood. After cauterization the area around the pustule is painted with iodin, and the wound is dressed with wet mercuric-chlorid gauze and an ice-bag is laid upon the gauze to prevent the development of organisms.

When excision is impossible the pustule and the tissues about it at many points should be injected every sixth, eighth, or tenth hour with a 10 per cent. solution of carbolic acid, a one-tenth per cent. solution of mercuric chlorid, or with 1 part of tincture of iodin diluted with 2 parts of water (Davaine). To ensure wide diffusion the puncture should be made beyond the area of infiltration, the needle be carried to the center of morbid action, and the piston be gently pressed as the needle is slowly withdrawn. It is a good plan to associate with these injections crucial incisions of the pustule and cauterization of the cuts. The inflamed lymphatic vessels and glands should be painted with iodin and smeared with ichthyol-ointment. The pustule should be dressed with wet mercurial gauze and an ice-bag be applied.

The internal treatment consists in the administration of stimulants, nutri-

tious food at frequent intervals, quinin, and possibly iodin or carbolic acid. Maffucci, who uses carbolic acid both locally and internally, reports most favorable results. Davies-Colley reports cures of anthrax by the local application of ipecac associated with the internal administration of the same drug in large doses.

It has been proposed to use electricity locally, but this agent can act only by setting free acid at the positive pole (Apostoli).

**Intestinal anthrax** and **pulmonary anthrax** are almost certainly fatal—the former by vomiting, diarrhea, and collapse, the latter by septic pneumonia. The treatment is symptomatic.

# HYDROPHOBIA.

By JOHN CHALMERS DaCOSTA.

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**Preventive Treatment.**—The preventive treatment of hydrophobia is a striking example of the great benefits that have resulted from laboratory-experiments. It is practically based on some of the vital theories of bacteriology; it in most instances successfully combats the malady; and it has destroyed a portion at least of the horror with which hydrophobia has been for centuries invested. This beneficent discovery is due to the illustrious Frenchman, Pasteur.

When a person is bitten by a rabid animal, the part should at once be excised, cauterized with a hot iron, and dressed antiseptically, and the patient be despatched to a Pasteur Institute without loss of time. It is quite true that a large majority of those bitten do not develop the disease, even if no special treatment be pursued. This varying liability depends on the location of the injury, the depth of the bite, and upon whether or not the poison have been partially wiped from the teeth of the animal in passing through the clothing. The largest number of cases develop hydrophobia after being bitten upon the face and the head; the next largest, after bites upon the naked hands and arms. Wolf-bites are more dangerous than dog-bites. Jaccoud estimates that two-thirds of all people bitten by rabid wolves develop hydrophobia. Roux estimates that from 12 to 14 per cent. of those bitten by mad dogs develop the disease. The smallest number of cases ever assigned in former days as following bites of mad dogs was 5 per cent. The observations of Pasteur upon preventive inoculations for chicken-cholera and for anthrax led him to study hydrophobia. He discovered the following remarkable facts: If the virus of a rabid dog (street-rabies) be inoculated beneath the dura of a dog, it always "takes," having a period of incubation of from sixteen to twenty days, death inevitably following in four days. If the virus be passed through a series of rabbits, it becomes stronger (laboratory-virus), and if it now be inoculated beneath the dura of a dog, it is found that the resulting disease possesses a short and definite period of incubation—from five to six days—and destroys life between the tenth and eleventh days. The virus can be attenuated by being passed through a series of monkeys or by keeping. If emulsions are made from the medullæ of hydrophobic rabbits dead from two to three weeks, a series of attenuated preparations of the virus will be obtained in a convenient form. Those obtained from the rabbits longest dead are the weakest—in that the weakest emulsion will not produce the disease in a rabbit, while the strong-

est emulsions will, unless the animal is protected by previous inoculations with weak virus. If dogs are injected with an attenuated emulsion containing the virus of a rabbit fourteen days dead, and then with emulsions of progressively increasing strength, until the medulla three days old is employed, the animal is bound to be immune to hydrophobia, and even intra-ocular injections or subdural implantation will not produce the disease. The duration of this immunity is not fixed. Some of Pasteur's dogs inoculated twelve years ago are still immune. The operation is entirely safe and harmless.

In July, 1885, Pasteur had the satisfaction of demonstrating upon a man, Joseph Meister by name, the truth of these observations upon animals.

These injections depend for their efficacy upon an antitoxin which, when introduced in sufficient strength and quantity, secures immunity against the poison of the slow-developing street-rabies.

Like all great discoveries, preventive inoculation has been overwhelmed with abuse. Vaccination is still denounced by some few ignorant fanatics, but the enemies of Pasteur have gone farther than even the opponents of Jenner. The latter class never claimed that small-pox did not exist; the former group do assert that there is no such disease as hydrophobia. The best answer to criticism is found in results. The last annual report of the Pasteur Institute of Paris shows that, during the year, 1648 patients were treated, with 6 deaths, and that in 4 of these fatal cases treatment had not been completed. In 132 persons bitten by animals whose madness was confirmed by experiment, not one developed the disease. Since the foundation of the Institute 14,430 patients have been treated, with 72 deaths, a mortality of only .5 per cent.[1] and one-twenty-fifth of the lowest estimated mortality before the introduction of the method.

**Curative Treatment.**—Until very recently it was almost axiomatic that hydrophobia was invariably fatal. Some few cures were alleged, but they were regarded with suspicion or uncertainty. The directions for treatment were to place the patient in a darkened and quiet room, to surround the bed with a screen, to administer stimulants and concentrated food by the rectum if necessary, to give morphin hypodermically in large doses, and to anesthetize from time to time or to administer amyl nitrite by inhalation (Forbes). An ice-bag to the spine, tracheotomy (Physick), chloral, the bromids, and curare have each found advocates. But recently Murri of Bologna cured a case of hydrophobia by injecting intravenously emulsions of medullæ of rabbits dead of rabies six, five, four, and three days respectively. The emulsion was allowed to settle and was used for eight days, when the patient recovered.

Since then Tizzoni and Centanni have demonstrated that subcutaneous injections of the blood-serum of a rabbit rendered immune to hydrophobia, given every second day for fourteen days, will cure rabbits with advanced hydrophobia. These observers have shown further that if alcohol is added to blood-serum from an immune rabbit, a precipitate forms, and the precipitate dissolved in water contains the active antitoxin.

[1] *Lancet*, April 7, 1894; T. Whiteside Hine, *Lancet*, May 14, 1892.

This vaccine of Tizzoni and Centanni is a neutral, odorless, aseptic solution, and contains 1 gram of nervous matter to every 10 cubic centimeters of fluid. One large dose renders a rabbit immune to hydrophobia, and several large doses will cure active hydrophobia in rabbits. These two scientists recommend vaccinating all dogs, in order to stamp out rabies.

Every city should have a Pasteur Institute, so that preventive treatment can be applied early and curative treatment be attempted, for the facts stated seem to be as clearly demonstrated as almost any in medical science, and the physician who will not avail himself of modern truth is worthy of the severest condemnation.

# TETANUS.

By JOHN CHALMERS DaCOSTA.

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Tetanus is an infectious disease, as was long ago suspected because of its occasional tendency to appear with endemic violence. It was very common among Napoleon's soldiers during the Egyptian campaign; Larrey found 100 cases the day after the battle of Bautzen; in 1858 it was epidemic in the London Hospital; and in 1782, 2944 infants died of trismus neonatorum in the Dublin Rotunda. Verneuil strongly asserted his belief in the infectious character of tetanus, but *proof* of this was not forthcoming until Nicolaier found the causative bacillus, and Kitasato obtained pure cultures and by injections of them into animals reproduced the disease.

Idiopathic tetanus does not exist. An injury is required to open the gates to infection. The germs of tetanus can be swallowed safely if the mucous membrane of the mouth, pharynx, esophagus, and stomach is intact, and the gastric juice will destroy the organisms. The unbroken skin, conjunctiva, and mucous membrane will not permit the entry of the bacilli of tetanus.

The injury that opens the system to invasion may be excessively severe or extremely slight. Tetanus may follow an amputation, a compound fracture, a punctured wound, a sting, a bite, a scratch, a splinter-wound, a slight abrasion, a frost-bite, a blister, or a hypodermic injection. The wound may be open and easily discovered, or it may have healed before symptoms appear. Sometimes tetanus follows wounds of the mouth, pharynx, or esophagus, as in the case recorded by Larrey, which was due to a laceration caused by the swallowing of a fish-bone. Punctured wounds are especially noted as being frequently responsible for the disease. If a nail runs into the foot, it carries with it various organisms which are deposited in the tissues. The tetanus-bacillus is especially common in the dust of old floors, masonry, stables, and gardens, and such nail may have upon it dust containing the bacillus. When the nail is withdrawn the pathway that it made is strewn with organisms, and contracts unequally at different points because of the varying degrees of tissue-elasticity in the various damaged layers. There is thus formed a closed chamber kept at the body-heat and filled with liquor sanguinis, blood-clot, and tissue-débris—a conjunction of circumstances most favorable for the growth of germs. Furthermore, the more or less complete exclusion of free oxygen favors the development of tetanus-bacilli, which belong to the obligate anaerobic group.

**Immunity.**—Frogs and pigeons are naturally immune to tetanus, and white

mice, when injected with the blood-serum of frogs or pigeons, are rendered artificially immune (Tizzoni and Cattani).

Rabbits, horses, and other animals can be rendered immune by the injection of attenuated cultures of the bacilli. Cultures greatly attenuated are first used, then cultures less positively attenuated, and, finally, virulent cultures. When the injection of virulent cultures induces no symptoms or only slight symptoms, the animal is immune, and the blood-serum of the immunized animal will confer immunity upon other animals if injected into them subcutaneously.

Tizzoni makes the interesting statement that a rabbit that has been subjected to splenectomy cannot be immunized.

Kitasato observed the important fact that rabbits can be rendered immune by injections of iodoform.

**Prevention of Tetanus.**—Prevention is accomplished by surgical cleanliness even in the most trivial operations. Perfect asepsis secures freedom from tetanus as surely as it secures freedom from septicemia. Instruments must be boiled carefully, as the spores of tetanus are tenacious of life, although steam or boiling water is fatal to them in five minutes. In treating every accidental wound, the wound and the skin about it should be cleansed thoroughly, and if the wound is extensive or deep or infected, free drainage should be provided. In every punctured wound the skin over a wide area should be scrubbed first with ethereal soap and water, next with ether, and finally with a solution of mercuric chlorid (1 : 500). The wound should be laid widely open to the bottom; foreign bodies removed; the wound scraped with a curet and scrubbed and irrigated with a 1 : 500 mercurial solution; bleeding arrested; drainage secured by horsehair or by a tube, or the wound packed with iodoform-gauze; dressed antiseptically, and maintained at rest and elevation. The tetanus of parturition is prevented by antiseptic midwifery. Trismus neonatorum is prevented by dressing the stump of the cord antiseptically.

**Treatment.**—When called to a case of tetanus, a wound should at once be searched for. If a wound is discovered, it should be enlarged for drainage, swabbed out with bromin, irrigated with mercuric-chlorid solution (1 : 500), dusted with iodoform, and either packed with iodoform-gauze or drained by means of strands of horsehair or a tube. If a recently healed scar is found it should be incised or excised and the resulting wound treated in the manner already described. The wound must be dressed at least once a day.

As the disease is infective, the patient should be isolated. The room is to be well ventilated, but free from drafts, and a temperature of about 70° F. (21.1° C.) should be maintained. The windows are to be darkened, a screen is to be placed around the bed, and quiet is to be insisted upon. Thus are avoided peripheral irritations whose tendency is to exaggerate or cause convulsive seizures. Food is given every two hours; it must be liquid, and consist of milk alone, milk with eggs, sherry, or whisky, liquid beef-peptonoids, meat-juice, etc.

If the patient cannot take food from a feeding-cup a nasal tube is passed into the pharynx and the nutriment is introduced by means of a funnel into

the free end of the tube. If spasms occur upon introducing the tube or attempting to swallow, the passage of the instrument may be preceded by the inhalation of amyl nitrite or of a few whiffs of chloroform. If food cannot be introduced by the esophagus, nutritive enemata must be resorted to. Whisky or brandy is given, the daily dose being determined by the patient's condition, and varying from ʒiv to Oj (125.–500.). Alcoholic stimulants were long ago recommended by Rush;[1] they lessen anxiety, favor muscular relaxation, and maintain the strength.

Constipation is sure to exist. The bowels must be moved at least every other day, by means of enemata.

Retention of urine is very common, and the catheter is to be used at suitable intervals.

*Antitoxin.*—In treating tetanus it is our duty to employ the antitoxin if we can obtain it, although the exact value of this plan of treatment is not as yet absolutely determined.

Tizzoni and Cattani[2] prepare the antitoxin from horses. The horses are rendered immune by the injection of attenuated cultures of tetanus-bacilli, and after a serum-bleeding are given a rest for a long time. Before a fresh extraction the horse is given subcutaneously an injection of a virulent culture of tetanus-bacilli. This is done to reinforce the efficacy of the existing antitoxin. The reinforcing injection produces symptoms that last for about one week (excitement, dyspnea, twitches or even slight spasms, fever, and some degree of exhaustion). In about twenty days after the reinforcing injection the serum should be drawn for use, as at this time it contains the maximum amount of the antitoxin. The serum soon loses its strength. The antitoxin precipitated from the serum by alcohol is said to dissolve with difficulty. The most reliable and soluble preparation is made by drying the serum completely in a vacuum and keeping it at a low temperature.

Remesoff and Fedoroff[3] have contributed a valuable report upon the tetanus-antitoxin. They injected a subject with 50 cubic centimeters of the serum of an immune dog, and noted a marked improvement in twenty-four hours. During the next three days a daily injection of 50 cubic centimeters was administered. The patient was cured by the fourteenth day. These authors review all of the previously reported cases treated with the antitoxin, and conclude that the use of this agent greatly diminishes the duration of the disease, lowers temperature, secures sleep, lessens the frequency and violence of the spasms, lowers the pulse-rate, and greatly improves the general condition. In order to determine the really curative value of the antitoxin, the fact must be noted as to how soon after the accident tetanus arose. Yandell said, over twenty years ago: "Recoveries from traumatic tetanus have been usual in cases in which the disease occurs subsequent to nine days after the injury; when the symptoms last fourteen days, recovery is the rule, apparently inde-

[1] *Transactions of the American Philosophical Society*, vol. ii.

[2] *Gazz. degli Ospitali*, April 21, 1894.

[3] *Centralblatt für Bakteriologie u. Parasitenk.*, Jan. 23, 1894.

pendent of treatment; that the true test of a remedy is its influence on the history of the disease—Does it cure cases in which the disease has set in previous to the ninth day? Does it fail in cases whose duration exceeds fourteen days?"

Until the antitoxin of tetanus has been thoroughly subjected to Yandell's clinical tests its true position as a remedy will remain uncertain.

If the antitoxin cannot be obtained, *iodoform* may be injected. Kitasato has shown that injections of iodoform render animals immune, and Sonnani claims that iodoform placed in a wound prevents the disease. The iodoform can be dissolved in ether or glycerin, and can be given hypodermically in doses of from gr. iij to gr. v (0.19–0.32) several times a day.

*Potassium bromid* is one of the most popular drugs in the treatment of tetanus. Wood records 15 cases treated with it, 13 of which recovered. Large doses are necessary—ʒj (4.) every two or three hours—small doses being absolutely useless. The bromid may be given alone, or from 10 to 15 grains (0.65–1.) of chloral may be administered with each dose. Sodium bromid may be preferred to the potassium-salt.

*Atropin* finds advocates in the treatment of tetanus. It may be injected into tetanized muscle. It acts by lessening the sensibility of sensory nerves and the excitability of motor nerves; it has been given in conjunction with the bromids.

*Aconite* has been employed to lessen the reflex excitability of the cord and to paralyze the end-organs of sensory nerves. It should not be given in tetanus, because of the danger that paralysis of the cardiac motor ganglia or of the respiratory center may ensue.

*Chloral* is of unquestioned value in combating spasm by exciting a paralyzing influence upon the motor centers. Knecht reports 134 cases treated with chloral, with 79 recoveries. Chloral is best given with potassium bromid. Chloral can be given through the nose-tube, by the feeding-cup, by means of enemata, or by intravenous injection.

*Amyl nitrite* tends to relax muscular spasm and lowers the reflex excitability of the spinal cord. It has been employed as the sole therapeutic agent, but its greatest value is as an adjunct to some other plan. It is of use to prevent spasm while taking food or medicine.

*Nitroglycerin* may be given hypodermically as a substitute for inhalations of amyl nitrite.

The application of an *ice-bag* to the spine alleviates somewhat the girdle-pain due to spasm of the diaphragm, and seems to diminish the violence and frequency of the spasms.

*Tobacco* was introduced as a remedy for tetanus many years ago by Mr. Earle. Hare records 19 cases treated with injections and fomentations of tobacco, with 9 recoveries. Nicotin can be given by the mouth in doses of ♏j (0.062), or by the rectum in doses of ♏ij (0.12), every two hours. Enemata of infusion of tobacco (3 or 4 fluidounces—90. or 120.) can be used, or the wine of tobacco in doses of half a fluidounce (15.) can be given by the stomach.

*Anesthetics* are used to suppress violent spasm that threatens suffocation or prevents the taking of food. Chloroform is preferred to ether by most surgeons.

*Opium* and *morphin* have been used largely in the treatment of tetanus. Large doses are well tolerated, and should be given if either of these drugs is used. The objection to their use is "the fact that they add to the constipation and are apt to produce vomiting." Demarquay advises deep injections of morphin into rigid muscles. Injections into the masseter muscles sometimes produce such relaxation that food can be taken with comparative ease.

Neurotomy, neurectomy, amputation, and nerve-stretching are not to be thought of in these days, when the true cause of tetanus is known.

Among other remedies that have been suggested, many being obviously useless, and some even harmful, are the following: Strychnin, hyoscyamus, duboisin, cannabis indica, warm baths, conium, cocain, gelsemium, curare, physostigma, quinin, bloodletting, turpentine, mercury, acupuncture on either side of the spines of the vertebræ, tartar emetic, apomorphin, arsenic, lobelia, applications of heat to the spine, vapor-baths, iron carbonate, a blister over the throat, frictions with oil, cauterization of the back with a hot iron, colchicum, the alkalies, cold baths, musk, camphor, and antipyrin, plugging the ears and keeping the patient in absolute darkness, carbolic acid by injection, and ergot.

We can sum up the treatment of tetanus in the following way:

1. Isolate the case.
2. Cleanse the area of infection, to prevent the continued absorption of alkaloidal poisons.
3. Antagonize the poison that has been absorbed, and do this by the use of injections of the antitoxin or of iodoform.
4. Combat spasm with chloral and bromid, amyl nitrite, or anesthetics.
5. Maintain the strength by stimulants and food.
6. Attend to the bladder and the bowels.

# GLANDERS.

By JOHN CHALMERS DaCOSTA.

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**Prophylaxis.**—In this most fatal malady the traditional ounce of prevention is worth the pound of cure. Horses laboring under the disease should be killed and their carcasses must be burned. The infected stalls ought to be torn out and rebuilt, and the premises thoroughly disinfected. A case of human glanders is to be at once isolated, and is invariably to be regarded as virulently contagious. It is contagious especially by the nasal discharge or the pus from abscesses or ulcers coming in contact with the mucous membranes of a sound person or with a cut or excoriation upon the surface of his body. The poison can, however, be introduced through the unbroken integument by entering into the hair-follicles (Babès). Because of the transmissibility by contact a person who attends a case of glanders in man or beast, who removes dressings, who buries or destroys a body, who disinfects a room or stable, should wear rubber gloves. The dressings and bed-clothing are burned and bowel-evacuations disinfected by means of carbolic acid, corrosive sublimate, or zinc chlorid.

Glanders is unquestionably sometimes transmitted by the inhalation of infected air. Well-authenticated cases of this mode of infection are on record, especially the well-known one of Dr. von Hoffman of Vienna. In consequence of this fact a case of glanders should be isolated in a large, well-ventilated room, and after the termination of the sickness the room should be thoroughly disinfected. The treatment of acute glanders is divided into *preventive* and *curative*, although, as the disease is almost invariably fatal, the latter designation is scarcely exact.

**Preventive Treatment.**—If an individual caring for a man or beast affected with glanders discovers an excoriation of his hands or face, or if he wounds himself with some object or implement (pins, splinters, the patient's teeth, etc.) that may be infected, the surgeon must at once institute active proceedings: excise the inoculated area; soak the part in a warm carbolized solution to favor a free flow of blood; dry the wound with gauze "sponges;" cauterize thoroughly either with pure nitric acid, pure carbolic acid, zinc chlorid of a strength of 1 : 8, or with the Paquelin cautery; dust the wound with iodoform; paint the surrounding area with tincture of iodin; apply antiseptic dressings, and watch anxiously for any evidences of the beginning of the disease, in the meantime dressing the wound as often as necessary. The period of incubation is variable, usually from three to eight days, but it may extend to three weeks.

Preventive treatment unfortunately is likely to be ineffectual. This is conclusively proved by the evidence of experimenters. Renault of Alfort inoculated horses with glanders, and practised excision and cauterization within one hour, yet all of the horses developed the disease. Bouley of Alfort made inoculations, and found that excision and cauterization within one minute failed to prevent the disease.

**So-called "Curative" Treatment.**—When called to a case of glanders the surgeon at once searches for any visible point of infection, and if he discovers such a point promptly excises it, cauterizes, dusts with iodoform, and dresses antiseptically. The procedure is advised in order to limit the dose of poison entering the system from the infected area. The general treatment should be strongly supporting. Concentrated nourishment is given at frequent intervals, alcoholic stimulants are ordered throughout the case in large and increasing doses, aromatic spirit of ammonia or ammonium carbonate is administered every two or three hours, and even oftener when the circulation flags, and quinin is used in doses of gr. v (0.32) three times a day. Morphin will be required for the muscular pains, restlessness, insomnia, sick stomach, and the adynamic diarrhea which is almost sure to develop. Enlarged glands and "farcy-buds" are painted with iodin, anointed with blue ointment or ichthyol, and at once incised, drained, cauterized, and rendered aseptic when they soften or suppurate. Edematous limbs are bandaged and supported. Suppurating areas and boil-like inflammations are opened, asepticized, dressed antiseptically, and often irrigated and re-dressed. Ulcers are scraped, irrigated with corrosive-sublimate solution (1 : 1000) or touched with zinc chlorid (1 : 8), dusted with iodoform, and dressed with mercuric-chlorid gauze. The nose is frequently sprayed with hydrogen dioxid thrown from an atomizer, and is syringed frequently with carbolized solutions or sulphurous acid. Inhalations of iodin and carbolic acid are employed. The kidneys are stimulated to secretion by digitalis or other drugs, and the mouth is rinsed repeatedly with a solution of potassium chlorate in glycerin and water. Among the numerous drugs that have been advised may be mentioned the sulphites and hyposulphites, potassium bichromate in doses of gr. $\frac{1}{4}$ (0.016), sulphur iodid, and strychnin arsenate.

*Treatment of Chronic Glanders.*—The patient should if possible be removed to the seashore. The general health is built up by food, tonics, and stimulants. Ulcers are treated by cauterizations, dusting with iodoform, and dressing with gauze; and the nasal passages are frequently subjected to antiseptic spraying and injection. The most useful drugs are iron, arsenic, strychnin, and alcohol.

# ACTINOMYCOSIS.

By JOHN CHALMERS DaCOSTA.

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Very little can be said of the treatment of actinomycosis. An effort should always be made to locate the primary seat of infection, and it should be remembered that infection takes place when there is a solution of continuity. In many instances this primary seat cannot be determined. Moosbrügger found the primary disease in 29 cases in the lower jaw, mouth, and throat; in 9 cases in the upper jaw and cheek; in 1 case in the tongue, in 2 cases in the esophagus; in 11 cases in the intestine; in 14 cases in the bronchial tract and lungs; and in 7 cases it could not be determined. Lesions may arise in the brain, rectum, prostate gland, or chest-wall. A tumor composed of embryonic tissue first forms; suppuration follows because of secondary infection. Inflammations due to actinomyces are never cured spontaneously. Rapidity of growth may lead to the confounding of actinomycosis with syphilis or osteomyelitis. The diagnosis should always be confirmed by the microscope. Infected soft parts should be cut away, infiltrated bone scraped and cauterized, the wound burned out with pure carbolic acid and dressed antiseptically. Cases are prone to relapse after apparent cure. In actinomycosis of the brain, trephining should be undertaken if localization is possible. Iodoform-emulsion locally is of benefit in some cases.

A most important addition has recently been made to our resources by the discovery that large doses of potassium iodid may cure actinomycosis, and that this drug strongly aids in preventing return after an operation. Thomassen and Nocard used potassium iodid with success in the "wooden tongue" of cattle. The administration of gr. xxx (2.) daily cured actinomycosis of the face when operation had failed (Buzzi and Galli-Valerio). An actinomycotic abscess of the chest-wall was thus cured in one month by Netter. Actinomycosis of the prostate gland and rectum was cured by gr. lx (4.) of potassium iodid a day.[1]

[1] W. B. Ransom: *British Medical Journal*, Jan., 1894.

# MILIARIA; MILIARY FEVER; SWEATING-DISEASE.

By AUGUSTUS A. ESHNER.

Of the nature of this peculiar affection we know little or nothing. Although at one time comparatively common and widespread, it has of late years been relatively rare and its prevalence has been largely restricted to parts of France, Italy, and Austria. This disease usually occurs in epidemics and is probably infectious in character, although not contagious in the ordinary use of the term. The two most striking symptoms and those from which are derived the names commonly given to the disease are profuse sweating and a general exanthem, though occasionally attacks are unattended with one or the other of these. The sweating is often the initial symptom, but it may be preceded for a day or more by gastric disturbance and general malaise. The exanthem, which is attended with itching, makes its appearance between the second and the sixth day, usually about the fourth; and this is associated with an aggravation of the attendant symptoms, which, however, subside as the eruption progresses. There appear upon a morbillous, scarlatiniform or purpuric basis miliary papules that are soon transformed into vesicles, which finally discharge and exfoliate. Occasionally death ensues before the appearance of the exanthem. Vesicles may appear upon the tongue and leave behind obstinate ulceration. It is believed that the mucous membrane of the gastro-intestinal tract may also be the seat of vesicles. The mortality from the disease has been variable, fluctuating from practically *nil* in some epidemics to as high as 80 per cent. in others. In favorable cases convalescence sets in at the end of eight or ten days and is often tardy.

Among the more prominent symptoms of the disease, in addition to the sweating and the eruption, are profound constitutional depression, general restlessness, violent delirium, syncope, painful muscular cramps, paroxysmal dyspnea without appreciable cause, a sense of depressing epigastric constriction, epistaxis, and hemoptysis. The pyrexia is as a rule slight. The bowels are usually constipated, the stools tarry and fetid. The urine is diminished, and may even be suppressed, but it presents no other abnormality. Convalescence may be attended with anemia, edema, general debility, fibrillary tremors, insomnia, and anorexia, and a tendency to perspire on slight provocation may persist for some time. Rectal crises and cardiac irregularity may remain as sequelæ. The disease has been most common in spring and summer, and has prevailed most largely in low-lying, damp districts.

The **treatment** is essentially expectant and symptomatic. It is not known through what channel the hypothetic infectious agent is conveyed, but care should be given to the water, the milk, and the food, and their freedom from contamination ensured. The patient should of course be confined to bed; and in view of the probable transmissibility of the disease, isolation should be practised. The dejecta of the sick should be rendered innocuous by means of milk of lime, carbolic acid, mercuric chlorid, or other disinfectant. Elimination generally should be favored. The sweating is not to be interfered with unless exhausting, or threatening collapse. This is probably Nature's mode of eliminating toxic matters. The secretion of urine should be gently stimulated through pure water given freely to drink, through alkaline diuretics, such as the solution of potassium citrate, or that of ammonium acetate, or through spirit of nitrous ether. Constipation is to be overcome by enemata or by saline laxatives given cautiously. Delirium, restlessness, insomnia, and general nervousness will require morphin, bromids, chloral, paraldehyd, sulfonal, trional, or hyoscyamin, singly or in varied combination, used with discrimination. Supporting measures will as a rule also be required, such as the use of alcohol and strychnin. The diet should be simple, digestible, nutritious. Convalescence will require tonics, such as quinin, iron, arsenic. Change of air and scene may be necessary to complete recovery.

# WEIL'S DISEASE; INFECTIOUS JAUNDICE.

By AUGUSTUS A. ESHNER.

The treatment of the disorder known as Weil's disease or infectious jaundice is as yet purely symptomatic. We are still unacquainted with the cause of the affection, and have but vague and uncertain notions of the conditions amid which it occurs; although there is reason to believe that it is due to the invasion of a specific micro-organism through the gastro-intestinal tract. The therapeutic measures to be employed must therefore be based upon our knowledge of the circumstances under which the disease has been observed, upon the morbid anatomy as far as this has been determined, and upon the indications presented by the individual case. The disease has been variously observed to occur in robust young men principally, in butchers and in soldiers, and especially in those who have been exposed to unfavorable hygienic surroundings. It has occurred in epidemic form among persons who have partaken of suspicious or actually diseased meat, imperfectly cooked or contained in sausages; also in those who have bathed in water polluted by fowl suffering from an infectious disease of analogous character. Most cases have occurred during the warm or hot season. The prophylactic deductions from these observations are the observance of ordinary hygienic regulations, general cleanliness, care as to the quality and preparation of food, and the avoidance of all debilitating influences that in general predispose to the invasion of disease. As the disorder is probably infectious, and thus transmissible, the usual precautions in the disposal of the dejecta and in the care of the bed-clothing and body-clothing of the patient should be scrupulously observed.

The disease may set in abruptly with pronounced febrile symptoms. The temperature ascends rapidly, the maximum elevation being attained in the first few days. The pyrexia is characterized by morning remissions. Among the most noteworthy symptoms are headache, vertigo, mental dulness, general malaise and debility, sometimes somnolence, sometimes fear and restlessness, muscular pains, excessive thirst, disgust for food, looseness of the bowels, jaundice, and albuminuria with tube-casts. Nausea and vomiting may be present at the onset. The spleen and the liver are enlarged, and the urine, as a rule, contains albumin and tube-casts. There is further a manifest tendency to hemorrhages from the mucous surfaces. The temperature begins to decline between the fifth and the seventh day, reaching the normal level on about the tenth or the twelfth day, and the symptoms abate. There now ensues an interval of freedom from symptoms lasting for four or five days,

when the febrile stage may be repeated, continuing, however, for a shorter time than at first and being followed by convalescence, which proceeds, as a rule, to perfect recovery. In fatal cases fatty degeneration of the liver and acute parenchymatous nephritis have been the most distinctive tissue-changes found after death.

In the absence of a knowledge of the cause of Weil's disease we have yet to await a specific form of treatment; and experience has not yet formulated a well-defined course of empiric medication. The general principles governing the treatment of acute specific febrile infections apply also here. The disease is a self-limited one, and mild cases may proceed to recovery without therapeutic intervention. The patient is to be placed upon his back in bed, suitably covered in accordance with the season, and shielded from external irritation. The diet should be restricted to milk and soft, easily assimilable food of unirritating and unstimulating character, small quantities being given at short and frequent intervals. Water may be permitted in generous, though not excessive, amount, to allay thirst, to attenuate circulating toxins, and to flush the kidneys. Small bits of ice may also be permitted to melt in the mouth. If nausea or vomiting be troublesome, relief may be afforded by the application to the abdomen of turpentine-stupes (great care being taken to avoid strangury and urinary suppression) or a mustard-plaster, by the administration of small doses of powdered ipecac (gr. $\frac{1}{12}$–$\frac{1}{10}$—0.0054–0.0065), mercurous chlorid (gr. $\frac{1}{6}$–$\frac{1}{5}$—0.011–0.013), and sodium bicarbonate (gr. j–v—0.065–0.32) at intervals of three hours; or of cerium oxalate in doses of 5 grains (0.32) thrice daily; or of cocain in doses of from gr. $\frac{1}{12}$ to $\frac{1}{4}$ (0.0054–0.016) from three to five times in the course of the day. Should constipation be present at the outset it would be well to give 5 or 10 grains (0.32–0.65) of mercurous chlorid, followed on the next morning by one or two teaspoonfuls (4.–8.) of some saline, such as sodium or magnesium sulphate, potassium and sodium tartrate, or sodium phosphate. If the bowels be unduly loose it were perhaps best to practise irrigation of the bowel with vegetable astringents. For this purpose the following formula may be employed:

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|---|---|
| Boiled water or infusion of chamomile, | 2 l. (2 qts.); |
| Tannic acid, | 5–10 gm. (gr. lxxv–ʒijss); |
| Powdered gum arabic, | 50 gm. (ℨjss). |

This solution is to be injected at a temperature of from 38° to 40° C. (100.4°–104° F.) and the injection may be repeated at intervals of six or eight hours. Gentle relaxation of the bowels need not be viewed with concern, as this is no doubt an indication of Nature's mode of elimination of noxious matters. Upon this assumption it is advisable to abstain from the administration of narcotics and opiates.

If the febrile symptoms be pronounced, solution of ammonium acetate or that of potassium citrate or spirit of nitrous ether in teaspoonful-doses (4.), with or without one or two drops or more of tincture of aconite or of vera-

trum viride, may be administered. If the temperature be high or the sense of heat distressing, resort may be had to sponging with dilute alcohol or cold water or even to the cold bath. Medicinal antipyretics, particularly the coal-tar derivatives, are to be avoided, owing to their depressing action when given in effective doses. It is not desirable to add the poisonous effects of drugs of this class to the intoxication already induced by the disease-process. The restlessless, the sleeplessness, the general irritability may require moderate doses of bromid (gr. x–xx—0.65–1.3), chloral (gr. x—0.65), paraldehyd (ʒj—4.) or sulfonal (gr. xx—1.3).

If symptoms referable to the kidneys become pronounced it may be necessary to apply cups, wet or dry, to the loins, to administer alkaline diuretics, to stimulate the activity of the skin by hot packs, hot baths with air or water, or by the judicious injection subcutaneously of pilocarpin (gr. $\frac{1}{6}$—0.011) and to see that the bowels are moved freely and regularly.

Convalescence may be slow and protracted and demands a gradual return to a full and nutritious diet and the administration of tonics, bitters, and ferruginous preparations—arsenic, strychnin, tincture of ferric chlorid. Change of air and scene, a residence in the mountains or at the seashore, or a sea-voyage may prove capable of shortening a tedious and tardy convalescence.

# CROUPOUS PNEUMONIA.

By I. N. DANFORTH.

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Acute croupous pneumonia is now regarded by the best authorities as an infectious disease, probably caused by the *diplococcus pneumoniæ* of Fraenkel. It must, therefore, run a definite course, and the disease *per se* should not be influenced or controlled by any known method of treatment. A possible exception may be made in favor of the "anti-pneumotoxin" of Klemperer, the practical clinical value of which is yet to be demonstrated. Until this or some other antitoxic agent shall demonstrate its antidotal power, it must be admitted that we have no specific treatment for acute croupous pneumonia. In fact the disease must henceforth be classed among the acute infectious diseases, if future observations confirm the conclusion that the diplococcus is its efficient cause.

Nevertheless, the physician must not fold his hands and look idly on while the diplococcus does its fatal work. There will be plenty of opportunity for him to display his skill, his wisdom, and his therapeutic common sense.

In an ordinary, mild case, involving only a part of one lung, without complications or distressing symptoms, the treatment will be very simple. It should include attention to the organs of elimination, the bowels, kidneys, and skin; regulation of the temperature, and ventilation of the patient's room; the administration of proper nourishment at proper intervals, and, if necessary, an occasional dose of Dover's powder or codein for the relief of cough, and to secure sleep. A mustard-leaf may be required if there is pain in the side, or a few leeches may be applied, but local applications will scarcely be necessary in a simple case of unilateral involvement. The crisis will occur at some time between the fourth and the eighth day, if at all, and recovery will generally be rapid and perfect. One caution may be suggested in mild cases of pneumonia—namely, not to let the patient get up too soon. I have seen severe and dangerous relapse as a consequence of too early exposure. In a severe case of croupous pneumonia the physician has occasion for the use of all his diagnostic acumen and for the exercise of his best therapeutic judgment.

In a typical case of croupous pneumonia, "four consecutive periods" (Douglas Powell) are easily recognized: (1) Hyperemia or engorgement, (2) consolidation or red hepatization, (3) crisis, and (4) resolution or gray hepatization. This, it will be observed, is a catalog of consecutive events arranged for therapeutic guidance rather than a strict pathologic history of the disease;

but, as each of these events has its peculiar dangers and complications, and as each has its characteristic symptoms, this arrangement presents a better clinical picture of the disease than it would if it were more severely scientific.

If resolution does not take place promptly and favorably the period of resolution or gray hepatization will be prolonged, and the condition known as "delayed resolution" will ensue, whereupon the case will no longer be a "typical" but a "complicated" one. Other complications are likely to arise as the case progresses, and these may require special treatment. We shall therefore consider, first, the treatment of the consecutive stages of a typical case of pneumonia, and secondly, the treatment of the complications in a case not quite typical.

1. **Treatment of the Period of Hyperemia or Engorgement.**—This is also very appropriately called the period of *invasion*. It is said to last from two to five days, but in the great majority of cases it passes into the next stage in from forty-eight to seventy-two hours. Patients are frequently walking about during this period, and it is quite common for individuals with incipient pneumonia to visit the physician's office on account of a severe "cold." If the practitioner be called early, if he recognize the malady promptly, and if he act vigorously and wisely, he may arrest the disease at this point, and thus avoid a long, severe, and possibly fatal illness. If either of these conditions be wanting, an immediate arrest is impossible. The patient should be sent to bed immediately in a well-ventilated room whose temperature is not above 65° F. (18.3° C.). The air should be moistened by steam. A capable nurse is all-important. A smart saline or mercurial cathartic should be administered, and renal elimination should be aided by potassic citrate or spirit of Mindererus. An exceedingly important question must be met and decided at this juncture, namely, Shall blood be drawn, and, if so, how, and how much? My own opinion on this point is positive, nor has it been hastily or unadvisedly formed. In a healthy, middle-aged adult, of either sex, with full pulse, flushed countenance, embarrassed respiration, dry râles, and smothered percussion-note, blood should promptly be drawn from the arm, until a decided impression is made. Ten, twelve, or even twenty ounces may be required—it does not matter about the quantity, the effect is the important thing, and it is useless to bleed at all unless the object is accomplished. While the blood-stream flows, the physician should keep his finger on the radial pulse, and watch with close scrutiny the character of the respiration; when the former becomes soft, yielding, and compressible, and the latter easy, full, and painless the remedy has accomplished its work and the bleeding may be arrested. Now the patient may be put into bed, five grains (0.32) of Dover's powder administered, a hot cataplasm applied to the side, and it is more than likely that a prompt arrest of the threatening symptoms will follow. If, however, venesection is not warranted, from six to twelve leeches may be applied over the affected lung, and bleeding from the bites may be encouraged by hot fomentations. Cups may be substituted for leeches, although the latter are preferable because they cause less shock and because bleeding follows the bites. Now and then depletion is

not allowable, and dependence will have to be placed upon flaxseed and mustard-poultices. I would, however, urge the careful and thoughtful consideration of the subject of bleeding in every case of incipient pneumonia before resort to other measures.

In former days the administration of aconite, veratrum viride, and allied remedies was practised very generally. Of these agents the favorite was veratrum viride, which, by lowering the rate and tension of the pulse, was believed to take the place of bleeding, and in fact to accomplish the same result. Perhaps no greater therapeutic fallacy ever gained credence in the profession. Douglas Powell characterizes the effect of remedies of the "aconite class" as that of "emptying the arterial into the venous system"; perhaps it might be more correctly described as converting the arterial into a venous system, as the slower and less forceful movement of the blood must inevitably result in its more imperfect oxygenation—in an emergency in which it is all-important that oxygenation should be helped along in every possible way. From any point of view the use of arterial depressants in the treatment of acute croupous pneumonia must be condemned, and especially and emphatically their employment as a substitute for bleeding when the latter is indicated.

Another question of importance during the first stage of pneumonia is: Shall antipyretics be administered, and, if so, under what conditions? When the thermometer shows a temperature of 103° F. (39.4° C.) or upward, and other symptoms of pyrexia are present, the practitioner finds it hard to resist the temptation to administer antipyrin or some equivalent remedy, which he is quite certain will reduce the temperature to normal or nearly normal. Before giving the antipyretic, however, let him remember that the fever of acute pneumonia is only transitory; that it is a normal factor of the disease; that it is not in itself hurtful; while, on the other hand, there are good reasons for believing that the accelerated metabolism incident to fever is beneficial, in that it destroys the *materies morbi;* that most of the antipyretics depress the circulation, while they all increase the labors of the already over-worked eliminating organs, and finally, that water, in the form of tepid or cold sponging, the cold pack, or, if obstinate hyperpyrexia be present, the cool bath—at about 70° F. (21.1° C.)—is the safest and most efficient antipyretic of all. I have never seen a case of pneumonia benefited by the internal use of antipyretics, while I have seen cases in which I was satisfied that their effect was depressing and harmful. It must not be forgotten that the conservation of cardio-arterial force and tone, to meet the emergencies of a later stage, is all-important, and that the favorite antipyretics certainly lower the cardiac power. My recent experience in the use of water by sponging and packs has been very gratifying, for reasons already indicated. Let the sponging be systematically carried out, the nurse being ordered to repeat it whenever the temperature rises above 101° F. (38.3° C.), the temperature of the water not being more than 80° (26.6° C.) and being gradually lowered to 70° (21.1° C.). The cold pack is an excellent substitute for sponging, as it makes less work for the nurse and less disturbance for the patient. A strip of doubled cheese-cloth, a yard wide and two

yards long, or an old, soft sheet folded lengthwise, may be wrung out of water at 80° F. (26.6° C.), and laid over the chest, abdomen, and extremities of the patient, who is then covered lightly with blankets. The sheet should be re-dipped in water every hour or two, until the object is accomplished. Not much internal medication will be required. If cough is troublesome or if pain is harassing, an occasional dose of morphin (gr. $\frac{1}{8}$—0.0081) or of codein (gr. $\frac{1}{4}$—0.016) may be given. If the opiate be combined with camphor or ammonium carbonate it will have a better effect, as it stimulates the functions of the skin; or a mixture like the following may be found useful:

℞ Codeinæ, gr. ij (0.13);
Liquoris ammonii acetatis,
Spiritus chloroformi, āā f℥iv (15.);
Syrupi lactucarii, ad ft. f℥ij (60.).—M.
S. A teaspoonful every three hours.

If the kidneys falter, a saline diuretic should be given; if the bowels are torpid, a Seidlitz powder or some other mild aperient may be needed; but no other medication will be required during this stage, unless special symptoms call for special treatment.

Local applications will be indicated. The choice lies between flaxseed-poultices, hot fomentations, the "pneumonia jacket" (made of cotton-wool, covered with oiled silk), and cold applications in the form of ice-bags, or towels wrung out of cold water. It is a matter of judgment which one of these should be employed. The physician should consider them all before deciding upon any one. The same case may be benefited by a change from warm to cold or from moist to dry applications; such questions must be determined by experience and by therapeutic judgment and acumen. A strong, healthy patient of middle age, or younger, is likely to be benefited by cold applications like the ice-bag; a person past middle age, unless unusually plethoric, is likely to be chilled by the ice-bag, while the warm poultice will be comforting and grateful. Children usually shrink from cold applications, which are utterly inappropriate for infants. My experience with cold applications in the first stage of croupous pneumonia, in properly selected cases, has been very satisfactory; but the aged, the very young, the anemic, and the "nervous," will do better with warm poultices. The cotton-wool jacket is better suited to the stage of consolidation. The foregoing measures, promptly applied, will arrest a considerable number of cases in the stage of "hyperemia," the only period during which such an event is possible. In spite, however, of the best-directed efforts, many cases will pass on to the second stage, namely, that of *consolidation* or *red hepatization*, which will call for some modification of treatment.

2. **Treatment of the Stage of Consolidation.**—This stage generally lasts from five to seven days; it may in exceptional cases terminate in forty-eight hours, but it is not safe to calculate on any such result. It is absolutely

useless to institute any radical "abortive" treatment during this stage—the time for that has passed. The therapeutic indications are, first, to sustain the patient's strength by appropriate nourishment; secondly, to guard against sudden collapse from heart-failure; thirdly, to watch the sound lung and protect it from passive congestion or edema; and, lastly, to be active and alert lest some complaint involving some other organ or function steal a march upon the physician and convert anticipated victory into defeat. Now, while all this sounds very formidable, it is really very simple; it calls for nothing but the exercise of good judgment and therapeutic "common sense." Milk, chicken-broth, oyster-broth, or mutton-broth, strong beef-tea, koumiss, and peptonized foods answer the first indication; but the nourishment should be given with systematic regularity, and the physician must see that it is so given. The second indication may not present itself if the patient is kept perfectly quiet, is not allowed to talk, and is spared the curse of company; but, if it does arise, it must be promptly met by the administration of strychnin and digitalis, with an occasional dose of nitroglycerin if the symptoms become urgent. Let the physician "cross-examine" the heart, not merely by feeling the radial pulse, but by placing the stethoscope over the heart itself; and he will frequently be able to anticipate, and therefore prevent, the dangerous symptoms that indicate a "tired heart." Spartein, strophanthus, or convallaria may be employed if the physician should prefer one of them, but unless he is well acquainted with their effects and peculiarities, he had better begin their employment during the treatment of some disease other than acute pneumonia. The first indication of systolic weakness and failure of arterial tonicity should lead to the administration of strychnin, together with small doses of digitalis; but the latter should be discontinued as soon as the heart's action is restored, while the former should be continued alone. So also, circulatory failure may call for alcohol; if it be accompanied by pallor, irregular sighing respirations, and intermitting pulse, the call is peremptory and decisive. Brandy, whisky, or wine should be given in moderate doses, from two drams (7.5) to half an ounce (15.) every hour, or two or three hours, according to the urgency of the symptoms; but the physician must remember that every dram of alcohol over and above that which is actually demanded is harmful, and should be withheld.

If the heart weakens to any serious degree, passive congestion, perhaps edema, of the sound lung will probably occur. Along with this we shall have dyspnea, more or less urgent, and considerable nervous anxiety and exhaustion. Under these circumstances a prompt resort to inhalations of oxygen will be demanded. In fact, it is better to begin the use of oxygen as soon as hepatization is fairly established, as this may present some of the symptoms already referred to. The oxygen should be administered every hour or two hours, or in case of great urgency every half-hour, about five minutes being occupied with each administration. This remedy may be continued with advantage throughout this stage of the disease.

The fourth indication—to watch the condition of other organs and func-

tions—is an important one. The eliminating channels must be kept open. It is especially necessary that the kidneys be encouraged if they falter, and that renal hyperemia be promptly met if its presence becomes apparent, as elimination of urinary factors must be maintained, or a fatal result may be expected. It is a maxim with me that a case of croupous pneumonia is not hopeless as long as the kidneys are in active service, and I have rarely known it to fail. So, also, the bowels must be kept open; the hepatic function must not be neglected, and the all-important work of the skin must not be forgotten. Not much medication will be required. If the cough is troublesome a small dose of codein—one-eighth of a grain (0.0081)—every three hours will be useful. I frequently employ the following formula:

℞ Codeinæ, gr. j (0.065);
Quininæ sulphatis,
Pulveris camphoræ, āā gr. xvj (1.037).—M.
Ft. capsulas No. viij.
S. One every three hours.

Another useful combination is the following:

℞ Ammonii carbonatis, ʒj (4.);
Syrupi pulveris Doveri, fʒiv (15.);
Syrupi pruni Virginianæ, fʒiss (45.).—M.
S. A teaspoonful every two or three hours.

I do not think expectorant mixtures accelerate the approach of the crisis, or in any way modify the severity or duration of the disease; they simply lessen the tendency to cough, allay irritation, and thus contribute to the comfort of the patient. They also satisfy the patient's friends, who expect the physician to give some medicine and are not satisfied unless it is done.

Local applications will be required during the stage of consolidation. Poultices, the cotton-wool and oiled-silk jacket, or the ice-bag may be employed at the discretion of the physician. Suggestions have already been given as to the cases to which each one is best adapted. If pleuritic pains or "stitches" develop, a fly-blister or a mustard-leaf over the seat of pain will give the most prompt relief. Tepid sponging or the wet pack will be indicated if the temperature is high, and the patient should be encouraged to partake freely of water, lemonade, or any other cooling drink.

3. **Treatment of the Crisis.**—In many cases of pneumonia the crisis is marked by an abrupt fall of temperature and copious diaphoresis or diuresis, or, rarely, by a free watery diarrhea. Sometimes, however, there is no definite crisis; the temperature falls gradually, and no critical discharge takes place, but convalescence proceeds without any decisive turning-point. When the crisis occurs suddenly, it brings with it more or less danger from heart-exhaustion, pulmonary edema, and nervous wear and tear. It is only necessary to call attention to these facts; the physician's duties will readily suggest themselves.

The period of crisis should be anticipated, its symptoms carefully watched, and the indications promptly met. Strychnin, digitalis, camphor, ammonium carbonate, the liquid preparations of ammonium, alcohol, and other equivalent remedies will answer every indication. One word of caution is proper: opium and the bromids should be avoided during this period, because they add to the depression of the already enfeebled vital forces, and because they tend to arrest and diminish the critical discharge that should not be interfered with unless for positive and imperative reasons—as, for example, when a critical diarrhea becomes exhaustive.

In a typical case of pneumonia the phenomena incident to the crisis are speedily followed by the fourth stage, or the *stage of resolution*, the treatment of which will now be detailed.

4. **Treatment of the Stage of Resolution.**—If convalescence proceeds favorably and without complications, very little treatment will be necessary. Nourishing food, perfect rest, the exclusion of company, and a continuance of the external applications may be all that is required. If cough is troublesome, some expectorant mixture like the following will be useful:

℞ Morphinæ sulphatis, gr. j (0.065);
Ammonii carbonatis, ʒj (4.);
Aquæ camphoræ, fʒj (30.);
Syrupi pruni Virginianæ, fʒij (60.).—M.
S. A teaspoonful every three hours.

Or a codein-pill (containing gr. $\frac{1}{8}$—0.0081) may be given instead. Wine or brandy may be indicated, but the physician should avoid the mistake, so often committed, of flooding every pneumonia-patient with alcohol, on the ground that it has some mysterious specific influence upon the disease. If the symptoms call for alcoholic stimulants they may be given, but not otherwise. I have many times seen a small cup of black coffee answer a better purpose than whisky, and it is generally far more grateful to the patient.

Now and then a case occurs in which resolution is delayed; cough persists, slight elevation of temperature remains, and an area will be discovered, generally posteriorly, over which harsh, dry râles are heard and the percussion-note, while not exactly flat, is dull and smothered. All this shows that a part of the lung is undergoing incipient fibrosis or cirrhosis. Potassic iodid should be administered in 5-grain (0.32) doses four times a day, and the surface should be painted with tincture of iodin.

During convalescence the patient should be kept quiet, and he should be cautioned against too much exercise and too early exposure, as a relapse is easily induced, and is more dangerous than the primary attack. Digestion and elimination should be carefully watched, and especial attention should be given to the condition of the kidneys, which are severely overtaxed in carrying off the waste incident to the acute inflammation.

If the patient can go to a warm, dry climate, of medium altitude, that is

free from paludal poisoning, it will be of great advantage. Many patients convalescing from pneumonia are greatly benefited by a sea-voyage, especially a trip to the Mediterranean ports.

The complications most likely to arise are pulmonary abscess, single or multiple, pleurisy, pericarditis, endocarditis, and meningitis, which should be treated independently in so far as is found practicable.

In conclusion I shall briefly refer to some proposed methods of treatment that have not yet established their claims to the confidence of the profession.

Petresco of Bucharest has since 1883 treated pneumonia with enormous doses of digitalis, claiming that the disease is thus arrested in the first stage, and the crisis hastened in cases that have entered upon the second stage. He administers as much as 2 drams (8.) of the powdered leaves in twenty-four hours—equal to about 2 ounces (60.) of our official tincture. I have had no experience with this treatment myself, not having had sufficient faith in its efficacy to warrant me in subjecting patients to its possible dangers. I have seen no explanation of the theory upon which Petresco uses these colossal doses of digitalis, but the practice does not commend itself to my judgment. It would certainly be dangerous to administer digitalis in such heroic doses in private practice in the city or in the country, where patients must often be left for long intervals to the care of untrained nurses, and this fact alone is sufficient to exclude the practice from general application.[1]

Lépine, Dieulafoy, and Bard, of France, have employed hypodermic injections of turpentine in cases of delayed resolution, or when it seemed probable that suppuration was about to take place in the lung. The object seems to be to produce a local focus of suppuration, in imitation of the practice introduced by Fochier in puerperal septicemia. The method is not one that holds out any promise of general permanent usefulness.

Lépine has also used injections of mercuric chlorid (1 : 10,000) in cases of gangrene of the lung following pneumonia—a practice based upon sound therapeutic experience.

The method of the brothers Klemperer of Berlin seems to give promise of positively beneficial results. It consists in the hypodermic administration of blood-serum from a patient convalescing from croupous pneumonia, or the similar use of blood-serum from animals that have been rendered "immune" by the previous injection of pure cultures of the diplococcus pneumoniæ. It

[1] Since the foregoing was written I have treated three severe cases of croupous pneumonia with continuous full doses of digitalis, in the wards of St. Luke's Hospital, with most satisfactory results. I employed a "normal liquid digitalis," one minim of which is the equivalent of one grain of the powdered leaf. Commencing with 3 minims every three hours, I gradually increased the dose to 10 minims every three hours, equal to 80 grains of the powdered leaf in the twenty-four hours. In each case the treatment was commenced after the stage of hepatization had fully developed, and was continued until convalescence was fairly established. No other treatment was employed, except an occasional aperient, or some simple expectorant mixture. In one case, which was admitted in an apparently desperate condition, with an intermitting pulse and a fluttering heart, the improvement was marked and immediate. In each case the benefit manifested itself in the sustained strength of the heart and the unfaltering vigor of the circulation.

is the belief of the brothers Klemperer that "the pneumococcus produces a poisonous albumin (pneumotoxin), which, when introduced into the circulation of the animal, causes elevation of temperature and the subsequent production in the body of a substance (anti-pneumotoxin) which possesses the power of neutralizing the poisonous albumin which is formed by the bacteria. In man they hold that during the pneumonic process there is a constant absorption into the circulation of this poisonous albumin produced by the bacteria in the lungs. This continues until eventually the same antidotal substance is produced in the circulation that has been seen to occur experimentally; it is then that the crisis occurs."[1] This antidotal substance—called by them anti-pneumotoxin—they produce experimentally in animals, or find ready-made in the blood-serum of a pneumonic patient who has passed the stage of crisis; and they propose to "induce the crisis artificially" (F. C. Shattuck) by injecting anti-pneumotoxin into the blood of pneumonic patients. Shattuck[2] has collected thirty-nine cases thus treated, whereof "all save one recovered." The results achieved thus far are certainly sufficient to encourage the hope that we are about to take a long step in advance in the treatment of croupous pneumonia.

[1] Osler: *Practice of Medicine*, 1892, p. 513.

[2] *Address before the Massachusetts Medical Society*, June, 1893.

# TUBERCULOSIS.

By JAMES T. WHITTAKER.

**Frequency of the Infection.**—Turn where we may in the practice of medicine, we have to face tuberculosis. Laennec declared in his day that more than one-third of the patients in the hospitals of Paris were affected with pulmonary tuberculosis. That was seventy-five years ago. Six years ago Cornet extended the number with the declaration that at least one-third of all mankind are or have been affected with tuberculosis. Cornet did not include in this statement diseases of the bones and joints, affections of the skin and glands, and the various hidden depots of the disease. Though they underestimated its frequency, the old masters did not err when they spoke of tuberculosis as the scourge of the human race, and we may hear the appeal of the later authorities all the way down from Louis, who wanted the various governments of Europe to unite in a crusade against it, to Virchow, who declared it to be the duty of man to suppress tuberculosis,[1] and to Koch, who, at the Tenth International Congress at Berlin, invited the nations of the earth to vie with each other in the study for the means of relief.

To be more concrete: In 4250 successive autopsies made in Breslau in the year 1893, gross macroscopic lesions of tuberculosis were found in 1393, that is, in one-third of all the cases that came to the post-mortem table. Boltz of Keil found 424 cases in 2576 autopsies. Biggs found characteristic lesions in the lungs alone in 60 per cent. of his autopsies, Brouardel in 75 per cent. of his cases at the Paris Morgue; and, as many cases show only fine lesions and others recover without lesion, it is evident that it is scarcely possible to overestimate either the frequency of the disease or the variety of its manifestations. Still more demonstrative statistics have been recently furnished by Schlenker. According to different authorities, tuberculosis is present in varying percentage in from one-fourth to two-thirds of all bodies, including latent tuberculosis and remains of previous disease. Schlenker examined one hundred bodies of adults and children. He not only made a complete autopsy of every part, but he subjected the lungs, and especially the apices, to a thorough scrutiny and then examined especially the mesenteric, bronchial, and cervical glands. In this examination caseous and calcareous processes were regarded as tuberculous; but simple adhesions were not so regarded. The microscope was seldom used.

Of the one hundred bodies, sixty-six were tuberculous. In these tubercu-

[1] "Es ist die Aufgabe der Menschheit die Tuberculose zu überwinden."

losis was the chief disease, that is, it was the cause of death in 53 per cent., was of great importance in 6 per cent., and was latent in 41 per cent. Considering together the cases in which tuberculosis was latent and those that showed no traces of tuberculosis, it could be said that 56 per cent. were non-tuberculous, and 44 per cent. showed latent tuberculosis. Thus, of the whole number of bodies two-thirds were affected with tuberculosis, while in the cases of non-manifest tuberculosis almost every second case showed a concealed depot. These numbers must, however, be regarded as minimal, because the examination was only grossly anatomic, not microscopic, and because even with the most critical examination by a special expert, concealed depots can be overlooked. From this work the conclusion is drawn that tuberculosis is more extensive than is generally believed. The difference in the number of cases according to different authorities is much less to be ascribed to any varying frequency of the disease in different regions than to the methods of examination.

**Tuberculosis in Man a Mixed Infection.**—Though tuberculosis is undeniably due to a single, definite cause, and is an absolutely specific process, as it is encountered in the body it is complicated with other affections. Hence, tuberculosis in the laboratory and in the domain of animal pathology is different in many cases from that of man.

It is impossible to study the action of a remedy in the treatment of tuberculosis without definite knowledge of the nature of the morbid process and what it is that is to be accomplished. It is now recognized that the whole character of pulmonary tuberculosis was not determined with the discovery of the bacillus tuberculosis. This is the keystone, it is true, but there are other stones nearly as important, which go to make up the structure. It is now known that tuberculosis, of the lungs at least, is not a pure process. In test-tubes, a culture, to be kept pure, must be protected from the outside air as a *sine qua non*. This exclusion does not obtain in the lungs. On the contrary, the tubes containing the cultures—*i. e.*, the bronchial tubes, are all open to the air, and are exposed to constant contamination. Thus it is that human tuberculosis differs essentially from laboratory tuberculosis.

The contaminating bacteria of sputum have been recently investigated by Evans and Babès. Maragliano called attention to the possibility of their clinical significance, as did also Czaplewski, Ziegler, and Thorner. Long ago, Koch in his work, and after him Gaffky, encountered the micrococcus tetragenus as an occasional associate of the tubercle-bacillus, and spoke of its pathogenic properties.

Cornet, in describing mixed infection, says that it is well known to every one who has experimented with tuberculous sputum in animals, that many of the inoculated animals, especially rabbits, often perish in a few days from septic processes. For years, in his experiments, he avoided the sputum of tuberculosis florida and selected rather that of chronic cases, because experience taught him that such sputum rarely causes death by accidental disease. In one case attended with an acute exacerbation there was found in the sputum,

besides the tubercle-bacillus, partly isolated and partly abundant diplococci and streptococci. Cultivation on agar gave almost a pure culture of streptococcous colonies. On post-mortem examination microscopic sections showed, especially in the walls of the cavities and in the caseous parts, large numbers of streptococci and monococci. On agar there developed innumerable streptococcous colonies, like those found in the sputum, and besides, but in less number, perhaps in the relation of one to twenty, the staphylococcus pyogenes aureus. The streptococcus grew in bouillon in firm masses and long chains, without making the fluid opaque, a property, according to Von Lingelsheim, peculiar to pathogenic streptococci. It resembled in form and growth the streptococcus described by Curt as *streptococcus agglomeratus.* An inoculated mouse died in three days. The same streptococcus was obtained from the blood of the heart, liver, and lungs in pure culture. An inoculated rabbit and an inoculated guinea-pig died, both in twelve days, and their organs were filled with streptococci.

Of the twenty cases investigated after death, and so far as possible during life, streptococci occurred twelve times in such predominance that their work in the production of the symptoms could not be questioned. Petruschky confirms this fact. He found the streptococcus predominant in the great majority of cases studied. In eight of fourteen cases, streptococci were found in the blood and juices of all the organs. Pasquale also demonstrated streptococci in various tuberculous processes. Therefore, the expression "mixed infection" is not exactly correct, because the condition is not one of simultaneous invasion. It is rather a secondary invasion of streptococci, that is, it is properly a wound-infection, and should be characterized as a "secondary infection."

The inundation of the whole body with streptococci induces septicemia. Hectic fever is distinguished by its morning remissions and by its more or less sudden evening elevation followed by sweats. It is the fever of erysipelas, acute suppurative processes, puerperal fever, etc., produced by pyogenic cocci, and in the great majority of cases by the streptococcus. Koch calls this see-saw record the "streptococcus-curve."

At the instigation of Weichselbaum, Ortner undertook to study closely the question of mixed infection in tuberculosis. He subjected sixty-one cases of different forms of tuberculosis of the lungs to a critical bacteriologic and histologic study, and divides the cases into three groups.

The first group includes those cases in which in addition to the tuberculous affection there were macroscopic pneumonic changes, in lobular or lobar extent. The second includes those in which there was macroscopic and simple marked granular tuberculosis, and the third the cases of acute, especially subacute, miliary tuberculosis of the lungs. In none of the investigated cases was there a genuine lobar pneumonia.

In most of the cases there was found, besides the tubercle-bacillus, a coccus which showed all variations from a typical streptococcus pyogenes to a typical diplococcus pneumoniæ. In the first group of twenty-seven cases the latter was found twenty-three times, the tubercle-bacillus twenty-five times. The

pneumonic and tuberculous processes are different, and may be each recognized by its own micro-organism.

Arribat also finds as the most frequent microbic attendants upon tuberculosis the streptococcus pyogenes and the micrococcus pneumoniæ.

**The Streptococcus in Hectic Fever.**—Jakowski made a number of examinations of the blood in cases of hectic fever marked by daily chills and sweats, and repeated these examinations a number of times, in the course of the years 1889 and 1890. Though these examinations included but nine cases, they furnish interesting results. The blood was obtained, after cleansing and disinfecting the skin of the finger, usually the middle finger, by puncturing with a sterilized needle. The first drop was washed off with sterilized cotton, and only that which appeared later, under pressure upon the finger above the puncture, was used. With this blood Jakowski made the customary cultures upon gelatin and agar, both in plates and in test-tubes, and demonstrated the staphylococcus pyogenes aureus and albus.

Observers have hitherto found chiefly the pyogenic streptococcus, although Cornet and Tschistowitsch saw also the staphylococcus pyogenes aureus. The majority of authorities now maintain that so-called hectic fever is caused by the penetration of pyogenic bacteria or their products into the blood, but there was not previously in literature any accurate statement of the discovery of these bacteria in the blood of such febrile patients. In the work recently issued by Charcot, Roger expresses the opinion that the destruction of the affected tissue is the result of the action of pyogenic bacteria, that the hectic fever is caused by them, and that it is but the manifestation of a septicemia. Marfan expressed the general opinion that the streptococcus and the pneumococcus had been found in the blood.

Jakowski found in the blood during the hectic period pyogenic bacteria nine times in seven patients. In one case a positive result was obtained only after the second examination; in seven examinations the staphylococcus was found oftener than the streptococcus.

Childhood also shows particular episodes and complications.

According to Marfan, the multiplicity of symptoms to which the tubercle-bacillus gives rise in the first years of life is due to a general tuberculosis, which makes itself manifest clinically by emaciation, cachectic micropolyadenia, enlargement of the liver and spleen, and ravenous appetite with undisturbed digestion. The usual apyretic course of this general tuberculosis takes on another character as soon as any particular localization occurs; thus, fever develops in consequence of meningitis, which is never an initial manifestation of tuberculosis, but must be always regarded as a complication of an already existing general infection. This form of disease occurs especially in children of neuropathic parentage, develops occasionally in several brothers and sisters, and often complicates the general disease. Autopsy discloses, as a rule, in patients dead of general tuberculosis, isolated tubercles in the lungs, much more rarely extensive caseous infiltration; when this last does occur, however, it shows itself mostly at the base of the lungs.

Bronchitis is easily developed in consequence of the swollen bronchial glands, and a bronchitis of frequent occurrence or with repeated relapse is, without being itself tuberculous, an evidence of general tuberculous disease. When broncho-pneumonia develops, the prognosis becomes very dubious, as it is then impossible to decide whether we have to deal with a manifestation of the general disease or with a tuberculous mass in the lungs. Catarrh of the middle ear often induces fever, and, occurring in children in the first years of life, is to be regarded in almost half of the cases as a localization of tuberculous disease. In other cases there occur transitory or more or less permanent febrile movements, for which the most careful investigation may not disclose a cause. The most frequent origin of the disease is from the depots that develop so frequently in the glands, especially in the tracheal and bronchial lymph-glands.

The development of tuberculous disease after whooping-cough and measles is not to be regarded as a complication of these affections; rather, these are complications that aggravate the existent tuberculosis, complications that lead it out of the latent into the manifest stage.

Of diseases of the abdominal cavity, peritonitis occurs more frequently in children above the age of seven, whereas smaller children suffer from the meterorism and disturbances of digestion that characterize caseation of the mesenteric glands. Both conditions, however, are merely episodes in the general disease. The same thing is true also of Pott's disease in children under the age of six. Lupus and scrofula of the cervical glands are, however, local. The blooming appearance, in the absence of every other sign of disease, justifies us in excluding general tuberculosis. Holsti found that, of 395 deaths in infants under the age of two, 81 were attributed to pulmonary tuberculosis, 265 to tuberculous meningitis, 46 to general tuberculosis, 3 to tuberculous enteritis. It is probable that most of the cases of so-called simple meningitis and a certain number of cases of so-called typhoid fever were cases of miliary tuberculosis.

Having thus noticed the frequency of the disease and the variety of its complications, it is necessary next to get the right idea of prevention and treatment, and to do away, if possible, with certain errors that have clung to tuberculosis for ages with all the persistence of prejudice. These errors pertain more especially to erroneous conceptions regarding

### Heredity and Predisposition.

Predisposition is defined as a defect in the constitution of an individual which lessens his resistance, and thus makes him more liable to invasion of the disease.

Is there a predisposition peculiar to pulmonary tuberculosis? Koster finds it, as Hippocrates did before him, in the paralytic thorax, which permits the easier colonization and multiplication of bacilli at the apices of the lungs. Such apices receive, according to Koster, no fresh air at all. They inspire only gases and bacteria from other parts of the lungs. We have, he says,

not so much to combat the bacillus as the disposition, that is, the build of the thorax, etc.

Wolff declares also that the danger of infection, at least in adults, is of far less importance than the danger of the disposition. He goes so far as to maintain that when an individual becomes tuberculous it is useless to investigate the past for the occasion of the infection. Infection may reach far back into childhood. Klebs is a decided advocate of a certain disposition as a necessity to tuberculous infection, and Hiller emphasizes the fact to such an extent as to say that it is not so much a question of infection with tubercle-parasites as of the presence of an individual bodily predisposition. If a man has this predisposition, he says, what would it avail to keep the bacilli out of his lungs for a certain time? When we consider their universal distribution, we must recognize that in such an individual infection is merely a question of time. The treatment, therefore, is not the treatment of the disease, but the combat of the individual tuberculous disposition. From this standpoint Volland asks, How shall a man protect himself from pulmonary tuberculosis? The only proper answer is, he says, that a man protect himself as much as possible from acquiring the disposition. For those in whom the condition has occurred in childhood this advice comes too late.

These authorities all assume the existence of a disposition, but, aside from the paralytic thorax mentioned, none attempts to define the condition in any way.

Sometimes this disposition is said to be acquired, sometimes it is inherited. With the subject of inheritance the question of disposition takes at once a wider range. May not the disease itself be inherited, that is, may not the tubercle-bacillus be directly transmitted to the offspring? This question necessitates at once a revision or readjustment of definitions. It shows at once a misconception of the term and a confusion of disposition with causation, for a direct transmission is not a disposition, it is the disease itself, and if transmission take place in all cases, it renders any study of predisposition superfluous. Even though the disease be latent, we do not say of a child born with syphilis that it is born with a disposition, but rather with the disease itself. Hence the question of direct transmission by heredity must be disposed of first.

Goldsmith says that man first gapes with wonder at the mysteries about him, and it is only when he ceases to wonder that he begins to study and observe. During the period of wonder he has the credulity of a child and his mind is satisfied with any explanation. It suffices at first to be told that the universe was created. As for tuberculosis, it was inherited.

With our immediate forefathers it was assumed, as the easiest explanation, that tuberculosis was always inherited. The only question with them was as to the degree of the descent, or of the relationship included. From what we know of the universality of the disease, we have learned that it is always possible to find tuberculosis somewhere in the ancestry. The proportion widens, of course, with the extent of relationship included. Thus, of 1010 cases at the Brompton Hospital, including only parents, the report shows an average

of 24.4 per cent. Cotton's 1000 cases, including parents, brothers, and sisters, gave 36.7 per cent. Fuller's 385 cases included grandparents, uncles, and aunts, and furnished about 60 per cent., and so on. But nowadays we do not reckon inheritance from uncles, cousins, and aunts. Williams estimates from his 1000 cases an average of 12 per cent. for direct hereditary predisposition, and 84 per cent. for what he calls family predisposition. Would anybody now seriously contend for inheritance of a disease from outside cause from grandparents? Attention may here be called to the fact that while in 43 of the cases of Williams the father alone was affected, in 67 the mother was alone affected, and in 224 brothers and sisters were affected with the disease. Surely this fact speaks more strongly in favor of infection than of heredity. The trouble with heredity is that it does not explain enough. It is admitted that of 100 cases affected with pulmonary tuberculosis, 12 will have had tuberculous parents, but if we recall the fact that these 100 patients had 200 parents, it will be seen that 12 represents heredity in but one-sixteenth of the cases, whereas we know already that tuberculosis is fatal in the lungs alone to one-sixth or one-seventh of mankind. We sometimes say of carcinoma that the rôle of heredity appears in 18 per cent. of cases, not enough to make it merit consideration. So far as figures speak, they show nothing for the heredity of tuberculosis.

Advocates of heredity find support in the fixation of the disease in families. Thus Riffel declares that the families of two villages in Baden showed the disease for more than one hundred years. Riffel made, as Langenhausen before him made, regular genealogic trees of families affected with tuberculosis. It is thus shown that when tuberculosis had once occurred in a family, it fixed itself with tenacity and remained up to the most recent time, following the members relentlessly to extinction.

Another factor invoked in support of inheritance is the predominance in children of affections of the glands, bones, and joints, recesses of the body not open to direct invasion from the outside, and reached only through the avenues of the blood-channels and lymph-channels. Scrofula is certainly much more frequent in childhood, but scrofula is an outside disease. It is just under the skin and in the line of the lymphatics from the throat. Diseases of the bones and joints in earliest life, that is, in the first weeks and months of life, are far more frequently due to syphilis than to tuberculosis. Hip-joint disease, white swelling of the knee, Pott's caries, creations of tuberculosis, almost never show themselves in the first months, and rarely in the first years of life. Nevertheless it is true that tuberculous affections of bones and joints are more common in childhood. Here, however, may be mentioned the discovery of Schede, that many of the inveterate chronic rheumatisms of age are tuberculous. The advocates of inheritance also claim tuberculosis of the skin as a hematogenous infection, but surely this should have been the last resort, for the skin is the very outside, and lupus, or other forms of skin-tuberculosis, are almost never found in conjunction with any internal deposit.

When we come now to the scientific study of inheritance of a disease pro-

duced by a distinct cause, we observe that the subject falls at once into two divisions, to wit: transmission at conception, that is, with the spermatozoid or ovum, and inoculation later in intra-uterine life from an infected mother. Sometimes these divisions are differentiated as germinative or conceptional and congenital, but these terms are so often used synonymously, or the last for all, as to lead to confusion. It must be at once admitted that there is no way of ascertaining whether a fetus was infected in the ovary or in the uterus, so that positive proof of absolute inheritance can be adduced only from the side of the father. As for congenital tuberculosis, *i. e.*, infection from the mother, it is not only possible but proved, though only as the great exception.

Definite results were obtained by De Renzi and Gärtner. De Renzi selected for his experiments guinea-pigs, which have a longer pregnancy than rabbits. Of eighteen experiments, five furnished a positive result.

Gärtner rubbed up the newly born young of tuberculous white mice, and injected the mass into the peritoneal sac of guinea-pigs. Among ninety-six young, out of nineteen casts, three cases of pronounced abdominal tuberculosis developed. Further, he injected into the blood of ten pregnant rabbits culture-solutions, and three of the fetuses extracted from the uterus showed bacilli. White mice and canary-birds were also used. These animals, while they are susceptible to the disease, do not succumb for at least three months after the injection of considerable numbers of tubercle-bacilli. Of 110 young mice, the offspring of twenty-four tuberculous (inoculated) mothers, two were found to be tuberculous. Of nine eggs from two tuberculous canary-birds, two contained tubercle-bacilli. The *possibility* of fetal infection is, therefore, established. Mafucci had already shown that infected hens' eggs need not perish but may continue to develop, while the issuing chick may show signs of general infection without local lesion.

Infection of the human fetus through the mother has been proved also. In the year 1891 Schmorl and Birch-Hirschfeld reported the first case in which they were able to demonstrate with certainty the transmission of the tubercle-bacillus from the mother to the fetus.

In reviewing these various observations, Ribbert concludes that we must admit that a large number of interesting studies may be utilized as points of support for the possibility of congenital transmission of bacilli, but that strict proof has been brought only for placental infection to account for congenital human tuberculosis. Infection in this way, however, is only a possibility, and that it does not thus occur as a rule is proved by the fact that the offspring of tuberculous mothers are commonly born sound and free.

Epstein observed that tuberculous mothers, notwithstanding emaciation of high degree, bring forth, as a rule, healthy and sound children, which develop in every way normally, and in the exceptional cases of feebleness at birth the emaciated children of such mothers recover perfectly when properly fed. Of 200 cases of this kind, tuberculosis was found upon autopsy only once, and then in a child aged ten weeks. The fact is, as Klebs has shown, that intra-uterine transmission of tuberculosis from an infected mother is one of the rarest

occurrences. Long before the discovery of the bacillus, Bockendahl declared, "We may not conceal the fact that pathological experiment has compelled us to recognize in tuberculosis an infectious disease, and to surrender the view of inheritance even in individual cases."

As to transmission from the father, which alone can constitute demonstrable heredity, there is no proof at all. Gärtner inoculated twenty-two rabbits in the testicle, and observed that although the semen contained bacilli, it failed in all cases to produce tuberculous young. The reason was obvious in view of the observation that in these inoculations only one bacillus would be present to fourteen million spermatozoids, so that the chances for infection in this way are reduced to a minimum. It could not further be shown that the spermatozoids ever incorporate bacilli. With any increase in the number of bacilli it was impossible to infect the fetus, and only rarely did there occur a local infection of the female. When it is considered that on the one hand the tubercle-bacilli are so rarely found in the semen, and, on the other hand, that primary congenital tuberculosis is itself so rare, it may be concluded that tuberculosis is never conveyed to the fetus by the spermatozoid. Thus, practically, tuberculosis is not an inherited disease.

**Transmission of a Tendency.**—As, now, direct germinative transmission of the bacillus cannot be proved in man, and placental infection is extraordinarily rare, retreat is had to the transmission of a tendency whereby, it is said, the children of tuberculous parents inherit a weaker constitution or some other peculiarity that constitutes a predisposition to tuberculosis, which in turn makes these children more ready victims to the disease. Why may not weak lungs be inherited as well as weak brains, weak stomachs, weak eyes, etc.?

Mention has been made here of the paralytic thorax, the elongated, flattened thorax, which is usually found in connection with a long, narrow neck, a thin skin with apparent blue veins, an enfeebled musculature, etc. This condition is declared to constitute the tuberculous habitus. The truth is that individuals presenting these peculiarities are often already the hosts of the tubercle-bacillus, and are not infrequently the victims of manifest disease. Deutsch has shown by abundant measurements and comparisons that there is no predisposition in the configuration of the thorax, and that broad-chested men contract the disease as readily as those with narrow chests.

It is claimed that certain catarrhal conditions of the mucous membrane predispose to the disease. This may be, but the fact has not been demonstrated. Brehmer says that a chief source of tuberculosis is a tendency to catarrh, and prevention of the disease consists in exercise in the open air, with protection of the skin with woollen but not too warm clothing, etc. The truth is here, too, the reverse of this relation. It is the individual infected with tuberculosis who is especially disposed to catarrh.

Conditions that markedly interfere with the nutrition of the lungs are declared to favor the retention and growth of micro-organisms. Thus it has been noticed that individuals in whom the pulmonary artery is small easily

become victims of this disease. Congenital stenosis of the pulmonary artery is nearly always attended with, or followed by, tuberculosis. On the other hand, certain anatomic conditions render an individual less liable to be attacked. Such conditions as favor venous stasis or hyperemia offer obstacle to the development of tuberculosis. Bier claimed to cure local tuberculosis of the joints by keeping them in a state of passive hyperemia. It is known that tuberculosis does not occur, as a rule, in cases of valvular disease of the heart, asthma, or emphysema. Schottelius finds a difference in the configuration of the bronchial tree. Formad accuses the constitution of the connective tissue. Weber attributes the disease to the absence of carbonic acid. Veraguth holds responsible the lymph-vessels. Ruehle generalizes in a lighter vulnerability, etc. Defective ciliary action has been invoked in the same way. Appeal is made to hypoplasia of the heart, and to chlorosis, both of which are common effects of the disease. Finally, Brehmer, in what might be called a frantic appeal for predisposition, lays the blame upon anorexia, for he says a common peculiarity of almost all cases is that the patients are never good eaters. This author actually put this statement in italics: "*Patient war nie ein starker Esser.*"

Pfeiffer states a well-known fact when he says that children of tuberculous parents are often sickly from birth. Affections of the mucous membrane are unusually virulent and obstinate, and complications are more wont to develop. For instance, in such children there is with every simple catarrh of the throat an inflammation of the ear, "not only once, but every time, and not only in one child of the family, but often in every one."

Affections of the ear are prone to occur, and tubercle-bacilli have been already actually demonstrated in half the cases. Here too, the sickliness of the child is the effect and not the cause of the tuberculosis.

Independent of inheritance altogether, the tendency is said at times to be acquired, and the same factors have been invoked, to wit, the paralytic thorax, the tuberculous habitus, the frequent occurrence of catarrh, defective ciliary action, hypoplasia of the heart, etc. The statement rests upon the same evidence as in the case of the inherited tendency, but more may be claimed perhaps for a chemic alteration of the juices or organs of the body, which may fertilize the soil for the growth of the tubercle-bacillus, or, what is more likely, lessens resistance to its invasion. Such a change certainly takes place in diabetes mellitus. It is a notorious fact that one-half of the cases of saccharine diabetes succumb to tuberculosis.

**The Bacillus Tuberculosis.**—The tubercle-bacillus is the one overshadowing fact in the whole history of this disease. It is the nucleus about which everything else must crystallize. Everything must conform to the tubercle-bacillus. It illuminates a whole field of obscure diseases. It reconciles discordant facts. It establishes unity. For instance, it is a far cry from a basilar meningitis to a hip-disease, from an otitis to an orchitis, from a miliary affection to an Addison's disease, from a lupus vulgaris to a fistula in ano. But the tubercle-bacillus explains all these things. Tuberculosis is conveyed by

infection, because it is conveyed by a living thing which grows only from itself. It belongs to the older civilizations, and is unheard of and unknown among newer peoples, as among the Australians, or our own Indians until it was brought to them by Europeans. Tuberculosis is therefore most frequent in those organs that are most exposed to the outside air. Long before the cause was known, Louis declared it to be a law that if tuberculosis is found elsewhere in the body, it will always be found in the lungs. In fact, tuberculosis is found first in the lungs, next in the intestine, third in the lymph-glands, as it is absorbed from these organs, and thence in other organs and tissues of the body. More recent studies confirm this fact. Thus of 221 autopsies of tuberculous cases, Grawitz found 152 cases primary in the lungs, 9 primary in the digestive tract, 3 arising from external wounds, while the original entrance of the infection was doubtful in the other cases.

Tuberculosis is most frequent and most intense in the most close and crowded spaces. A sentence of imprisonment for any number of years is a condemnation to death by tuberculosis. Cornet has shown that 60 per cent. of nurses succumb to tuberculosis. It is useless here to dwell upon this fact. No one now refuses to believe that tuberculosis of the lungs is acquired by inhalation of the tubercle-bacillus.

**Avenue of Infection.**—Tuberculosis deposited in the recesses of the body is preceded by deposits in the course of the main avenues. Mention has been made already of depots in the bronchial glands and in the mesenteric glands. The disease irradiates from these centers. Sometimes a secondary deposit is more concealed and the disease is disseminated from this cryptogenetic source. Babès found affection of the bronchial glands in the Children's Hospital at Budapest in more than half his sections. Müller of Munich found the same condition 103 times in 500 sections.

Northrup found caseation limited to the bronchial glands 42 times in 125 cases. In three cases only were the mesenteric glands primarily infected. Engelnäh made a bacteriologic examination of the lungs and the bronchial and mesenteric glands in 120 individuals that died at a St. Petersburg Hospital during six weeks in the fall of 1891. Tubercle-bacilli were found in fourteen cases (11.7 per cent.) at ages varying from two months and four days to seven months and seven days. They were present in both the lungs and the bronchial glands in 93 per cent. of cases. Neumann goes so far as to say that children dead of tuberculosis of any organ always show affection of the bronchial glands, and that affection of the bronchial glands depends always on infection with tubercle-bacilli. In the few established cases of fetal tuberculosis, however, the bronchial glands were not at all or only very insignificantly affected.

Tuberculosis is, therefore, extremely rare in the first months of life, and is almost never seen in foundling asylums. In the foundling asylum at Prague, Epstein saw in 200 post-mortems only 9 cases of tuberculosis. Two of these children had been brought into the institution from an outside nursery, in which one of the nurses had been affected with the disease. The history of

the others was unfortunately not inquired into in this direction. But in the case of seven of the sucklings, the mothers had been brought to the hospital to be treated for pulmonary tuberculosis. In the St. Petersburg foundling institute, according to Froebelius, among 71,370 foundlings, the deaths from tuberculosis equalled 0.4 per cent., while the whole number of deaths was 21.7 per cent. Again, the anatomic situation of the glands indicates infection by inhalation. Buchner and Wyssokowitsch showed in their experiments that the inhaled spores of various kinds of bacteria could penetrate to these glands without lodging in the lungs. From these glands the bacilli irradiate.

According to Weigert, miliary tuberculosis of the lungs is a consequence of invasion of the pulmonary veins from the intra-pulmonary glands. In nearly all such cases, examination of the mesenteric and cervical glands will show that the lungs constituted the avenue of infection.

When we consider the universality of tuberculosis, we may be led to ask the question whether the subject of predisposition is not one rather of dissemination in the body of the individual than acquisition in the first place. This subject opens up the field of invasion by other, especially the pyogenic, micro-organisms, which are chiefly responsible for the spread of the disease in the body. Whatever degrades the body in any way favors the development and dissemination of disease—of any disease, including tuberculosis. In this sense and in this sense only may be admitted a predisposition to tuberculosis. We may recall in this connection the history of the celebrated rabbits of Trudeau. A number of animals were inoculated with like quantities of tuberculous virus. Half of them were allowed to run free in the open air; the other half were supplied with food and drink and immured in a dark hole under ground. The animals were all killed at the same time. Those that had run free had either recovered entirely, or showed only localized lesions. The immured animals showed wide dissemination of the disease. The weak and feeble from whatever cause are the victims of disease. Birch-Hirschfeld long ago showed that the mortality at the end of the year is not increased by the prevalence in its course of any epidemic: the epidemic numbers its victims among those who would have died from other causes. The idea of a predisposition is dangerous, because it removes attention from the avoidable sources of the disease. It is unsatisfactory in that it does not prove enough. It is also undemonstrable, and the experiments made to prove it are all open to objection. Finally, it is superfluous.

Tuberculosis is acquired by infection. The attempt to deduce conclusions from the laboratory is often greeted with contumely; it is a common saying, especially among clinicians of the old school, that man is not a test-tube. The fact is that he is a test-tube, enclosed in skin instead of glass, but containing a much more complex culture-soil. Like the test-tube, he stands about with open mouth and receives what falls into it from the air; and those who believe in predisposition leave him standing helpless, without the power of removing the contaminations in the air. If we do not understand the changes that take place in the culture-soil in the interior of his body, it is not the fault of the fact.

I have many a time had this experience: I have been called to see a case, often in a tenement-house, sometimes in an underground room, sometimes in a log-cabin in the country, to find the patient lying in bed in the last stages of tuberculosis, unable to lift his head to expectorate, the floor about the bed covered with newspapers saturated with sputum which had been projected in a parabolic curve. The condition of the bed and of the adjacent walls may be surmised. In this same room not infrequently the wife or mother was washing clothes, some of which were hung up to dry, so that the air was saturated with steam, and in this same steam-heated, polluted atmosphere, little children with half-naked bodies were picking their way about the room with bare feet. When, in the due course of time, the little ones thus inoculated showed some of the localizations of tuberculosis, they might not have to travel far to find a physician who would dub the disease hereditary, and resign himself to the hopelessness of the situation.

### Prophylaxis.

The tubercle-bacillus is practically indestructible in the body; hence the absolute protection of the human race turns upon prophylaxis. The fact that in the vast majority of cases tuberculosis is disseminated by dried sputum and is received into the body through the mediation of the lungs leads inevitably to the conclusion that the disease may be extinguished by the destruction of the sputum. It is known that sputum represents something more than a mere culture-soil. The sputum contains colonies of the tubercle-bacillus. Diluted 400,000 times and injected into the bodies of guinea-pigs it will still propagate the disease, and the bacillus dried in the sputum upon cloth will retain its vitality for six months. The destruction of sputum out of the body is possible, but impracticable. But while the sputum may not be destroyed, it may be imprisoned beyond the possibility of release. So long as the sputum is kept moist the bacillus is retained in it, as no particulate body may rise from a moist surface.

It must be remembered that nothing about the patient is infectious except the sputum and the material upon which it dries. Institutions for the reception of patients in which rules for the destruction or retention of sputum are rigidly enforced furnish by actual demonstration an atmosphere most free from infection, so that it is often said that these are the places in which best to avoid the disease.

**Disinfection of Sputum.**—Gärtner makes the following practical suggestions:

Bacteria cannot rise from sputum so long as it is wet; therefore sputum must be kept moist.

Sputum-cups (Fig. 14) should be provided with covers, to prevent the entrance of flies, which carry away bacteria both on their feet and in their intestinal canal. At times use must be made of cloths, which should then be changed at least twice a day, and if not burned, immersed in boiling water or in a disinfecting solution. The best of these is a 3 per cent. solution of lysol.

Cuspidors should never be filled with sand or sawdust, but with water. They should be so constructed that they cannot be upset. The best sputum-cups are made of pasteboard, and filled, according to the suggestion of Prausnitz, with wood-wool, which absorbs rapidly. The cup and all its contents are

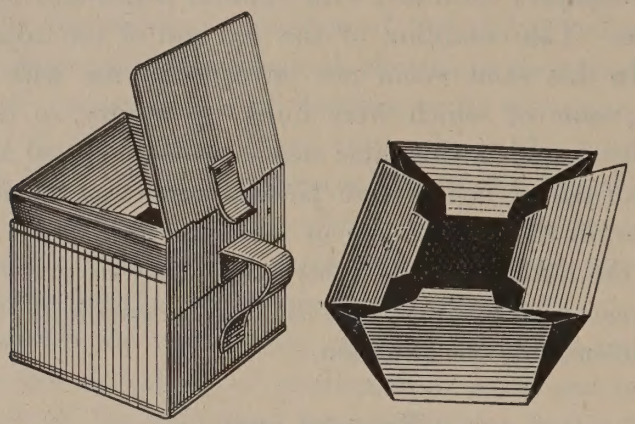

FIG. 14.—Sputum-cup.

consumed by fire every day. When sputum is received into water it is not necessary to use a disinfectant. When the use of a disinfectant is deemed necessary, the best preparations are lysol and crude solutol. Both of these preparations have the advantage over carbolic acid that they do not coagulate the sputum, but on the contrary they fluidify it. Spengler found that it required a 10 per cent. solution of lysol to kill tubercle-bacilli in twelve hours. Crude solutol must be present in the proportion of from 5 to 10 per cent. It is understood that these proportions include the amount of sputum, as a disinfecting solution which may be at first from 5 to 10 per cent. becomes diluted by the addition of sputum. This fact must be kept in mind. Sputum should be disinfected in the cuspidors, and not simply discharged into sewers, for Schottelius has shown that bacilli retain their virulence for two years in the lungs of buried bodies. Sputum in cuspidors with wide mouths may be mixed with sawdust and burned, or in institutions the fluid itself may be boiled half an hour in large vessels, or may be disinfected with the preparations mentioned. The cups, cloths, etc., may be scalded or boiled.

**Disinfection of bedding, clothing, furniture, etc.** is best effected in the steam-apparatus which is now, or should be, found in every city under the charge of the health-officer. Clothing—that of the physician, for instance—may be disinfected by being packed loosely in chests with alternate layers of wool saturated with a 40 per cent. solution of formalin. Disinfection is perfect in two hours. To remove the disagreeable odor of formalin (formaldehyd) the clothes are removed to a second chest, whose interior has been sprinkled with ammonia. From this combination is developed hexamethylentetramin, which is without odor. Leather furniture, furs, etc., may be disinfected in this way. This method has also the advantage of cheapness. It is equally effective against all sorts of parasites that the physician may introduce into his family with his clothes. The disinfection of houses and sick-rooms can

only be done by people trained for the work. Everything in the room must be removed. The beds, mattresses, pillows, covers, linen, are packed in sacks which have themselves been saturated with carbolic acid. Rugs are rolled up enclosed in cloth. Clothes are put in a box. All these things are conveyed at once to the disinfecting apparatus. Furniture is removed, papered walls are rubbed down with bread, the crumbs of which are swept up and burned. Tinted walls receive a new coat, which, if it does not kill the bacteria, fastens them to the wall, where they certainly perish in time. Oil-painted walls are rubbed down with a 5 per cent. solution of carbolic acid, or with calcium carbonate, which is washed off in two hours. All wooden furniture of every description, doors, windows, sills, etc., are washed down with a 3 per cent. solution of carbolic acid. Furniture must be cleaned behind and below, as well as in front and on top. Picture-frames must be handled in the same way. Children's toys should be steamed or washed off in a 3 per cent. solution of carbolic acid. Soiled or worthless things of this kind should be burned. Lamps, door-handles, gas-pipes, and chandeliers should be washed off in a 3 per cent. solution of carbolic acid and subsequently dried. Furs may be wet with a 3 per cent. solution of carbolic acid and then rubbed off with cloths and dried thoroughly in the air. Cheap books are best burned. Books of some value may be put in a chest with formalin, and so arranged that the formaldehyd may penetrate between the leaves. Strong sunlight helps to disinfect these materials. Floors are scrubbed with a 3 per cent. solution of carbolic acid, or brushed with calcium carbonate and washed off in two or three hours.

**Food and Drink.**—Invasion by the alimentary canal is infinitely more rare than infection through the respiratory passages, as meat and milk are much less frequently infected. Thus, Bang called attention to the danger of milk and meat from tuberculous animals, but warns against any over-estimate of this danger. If the udder itself is not attacked, the milk of tuberculous cows contains tubercle-bacilli only exceptionally—nine times in sixty-three cows. Boiling or steaming sterilizes milk. In meat bacilli are to be found only when they have freshly been carried by the blood-stream. Muscular tissue is certainly an unfavorable soil for their growth and development.

Bollinger injected the fresh blood of tuberculous cattle into guinea-pigs. Of ten guinea-pigs inoculated in this way by Hagemann in the Pathological Institute at Munich, nine remained healthy, while one showed marked tuberculous infection. Seven weeks after the inoculation there was tuberculosis of the spleen, of the liver, and of the abdominal and intra-thoracic lymph-glands. The conclusion is that the blood of cattle affected with *Perlsucht* possesses in certain cases infectious properties. In the successful case mentioned the blood came from an animal affected with the disease in high degree, in medium condition of nutrition, and whose flesh had been furnished to man as food. As a rule, such flesh is rarely sold for consumption; nevertheless, as it is known that no flesh is absolutely free of blood, as about one-third of the whole blood remains in the body after the ordinary means of slaughter, it is seen that flesh is not entirely free from danger.

It goes almost without saying that infants should not be fed at the breasts of tuberculous mothers or nurses.

Prevention follows absolutely with conviction as to the infectious nature of the disease. Thus, Behrens concludes that the rules for the prevention of the inheritance of tuberculosis, that is, of the disposition to tuberculosis, rest upon no solid ground. Rescue depends upon active combat of every source of infection, which consists: (*a*) In the education of the public in relation to the contagion or the infection of tuberculosis. (*b*) In police regulations regarding the inspection of tuberculous products in places where many men congregate. (*c*) In the prevention of the development of dust on the street. (*d*) In the construction of public disinfecting institutes and suggestions as to the disinfection of houses in which the tuberculous have died. (*e*) In the erection of public institutions for poor tuberculous patients.

Moreover, tuberculous patients are to be excluded from occupations that make the disease dangerous to others. Regulations are further to be made regarding animals.

### Treatment.

The hope of treatment is based upon the fact universally acknowledged that tuberculosis is often cured outright spontaneously, and that it even more frequently becomes latent and quiescent. Reference may be again made here to the statement of Schlenker, already quoted, that the disease was latent or showed only relics or traces in over 40 per cent. of cases; to a similar statement made also by Brouardel of the Paris Morgue; and to that of Loomis, who reports, of 763 autopsies, 71 cases of tuberculosis cured, the patients having died of other and different diseases. The cure was effected by a marked increase of connective tissue. But that the cure is not always so perfect as appears to the naked eye was demonstrated by the discovery of tubercle-bacilli in three of twelve lungs examined.

As every physician knows, even desperate cases may recover. The capital fact is, as Marfan declares, that tuberculosis is curable spontaneously, and this fact should dominate the whole chapter of the therapy. The treatment proper is addressed to both the seed and the soil, and in the address to the seed it is recognized, as stated, that the bacillus is almost indestructible.

**Action of Chemicals.**—Up to the present time we know of no substance that will destroy the bacillus tuberculosis in the body, but there are several remedies that inhibit its development. The following statements are made upon the authority of Marfan. Salicylic acid in the strength of 1 : 500 does not destroy the virulence of the bacillus. Bromin is inefficacious in a strength of 1 : 1000; it acts in a strength of 1 : 500, but in this proportion the solution is caustic. Phenic acid has a doubtful effect in a strength of 5 : 100 or of 6 : 100; but it is caustic. Creosote is without destructive action in a strength of 1 : 1000. Hydrofluoric acid destroys the bacilli in a strength of 1 : 4000, but is very caustic. Sormanni and Brugnatelli rank substances according to their antiseptic properties in increasing value thus: Lactic acid, camphoric

acid and camphor, ethyl bromid, beta-naphthol, turpentine, palladium chlorid, phenic acid, mercuric chlorid. According to Yersin, whose researches were made upon aviary tuberculosis, tubercle-bacilli are destroyed by an exposure of thirty seconds to the action of phenic acid in a strength of 5 : 100, of one minute to the action of a solution of 1 : 100, of five minutes to the action of absolute alcohol, of five minutes to the action of iodoform in a strength of 1 : 100, of ten minutes to the action of mercuric chlorid in a strength of

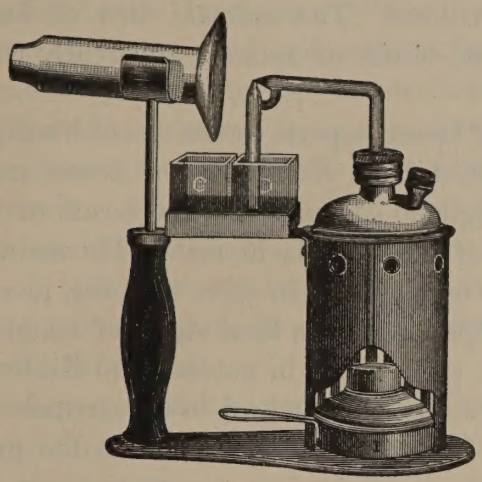

FIG. 15.—Steam-atomizer.

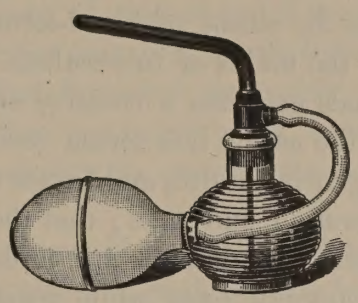

FIG. 16.—Bulb-atomizer.

1 : 1000, of three hours to the action of thymol in a strength of 3 : 1000, of six hours to the action of salicylic acid in a strength of 2.5 : 1000. They resist boiling for more than twelve hours, and exposure to the action of boric acid in a strength of 4 : 100.

Villemin studied the action of 150 substances upon the development of cultures of tuberculosis, probably of aviary origin, and gives a list of those agents in which the colonies seem to thrive; a second category in which the cultures are inhibited; a third in which they are notably retarded; and a fourth in which they are completely sterilized. According to Koch, the agents that succeed best in arresting the development of the bacillus of human tuberlosis *in vitro* are the essential oils, the aromatics, like beta-naphthol, paratoluidin, certain anilin colors, fuchsin, methyl-blue, gentian-violet, and auramin. Next come the mercurial vapors and the combinations of silver, and especially those of gold, with hydrocyanic acid. Thus gold cyanid prevents the multiplication of the bacillus in a solution as weak as 2 to 1,000,000. Koch adds, however, that none of these substances suffices to cure a tuberculous animal.

**Serum-therapy.**—The hope of securing immunity by injecting the blood-serum of an animal refractory to tuberculosis, or by the serum of a tuberculous animal, after the manner pursued in tetanus, diphtheria, etc., proves illusory, if only from the fact that there is no absolute immunity. Héricourt and Richet injected the serum of the blood of the dog, an animal supposed to be refractory to tuberculosis—an error now universally recognized. Picq and Bertin used the blood-serum of the goat; but this animal possesses no im-

munity whatever to human tuberculosis. The favorable results obtained by the injection of such serum are attributed in our day to the tonic or nutritive action of this fluid. Bouchard, in experiments of the same kind, failed to get the least curative result, but found rather, on the contrary, that the transfusion of the blood-serum of the goat led to a more rapid development of the disease. Doves and pigeons, which have a great receptivity for aviary tuberculosis, seem to be refractory to human tuberculosis. Martin injected into the peritoneum of a guinea-pig the blood-serum of doves and pigeons which had received without result human tuberculosis. The animals died of human tuberculosis. Treatment with the blood-serum of animals apparently refractory gives no result.

In the same direction, Maragliano of Genoa reports the results of his experiments by means of blood-serum obtained from dogs, asses, or horses treated with the toxins of tuberculosis. Maragliano contends that the serum of these animals exercises a curative effect upon tuberculosis in man. He maintains that the use of this serum reduces the temperature in cases of fever, increases the general health, and causes the dissipation of the local signs, of cough, expectoration, and râles; that the bacilli are reduced in number and finally disappear. He declares that prolonged results are obtained in the circumscribed and apyretic cases, while remarkable improvement is reached in the graver cases.

Paquin of St. Louis uses the blood-serum of the horse, and claims remarkable results. The cases in the first and second stages of the disease were reported to have been cured after from four to six months of continuous treatment.

The reports in both these cases are simply clinical, and the conclusions rest upon no scientific foundation. Maragliano, for instance, finds himself justified in ascribing specific effects to his serum from the observation that the injection of the serum into the body of a patient affected with tuberculosis prevents the local and general reaction that occurs after the use of tuberculin; and Paquin justifies himself in his conclusion by "considering that tuberculosis [presumably of the lungs] is fatal in 99 per cent. of cases." All the "good results" obtained may be attributed to the general bactericidal or antitoxic property of blood-serum in general.

**Immunity Conferred by Another Disease.**—According to Solles, the inoculation of erysipelas prolongs the life of tuberculized guinea-pigs. Perroncito declares that cattle and rabbits vaccinated in protection against charbon become almost refractory to tuberculosis. According to Winogradow, pulmonary tuberculosis is mitigated by inoculation with the vaccine of the heifer. Tyndale made a somewhat similar observation. Kostjerim and Krienski tried to vaccinate animals against tuberculosis by inoculating them with tuberculous sputum, filtered and putrefied. They claimed to have obtained favorable results, but Daremberg, who repeated their experiments, got no appreciable results. Imbued with the idea of putrefaction in destroying the virulence of bacilli, Cantani caused a number of patients to inhale liquid cultures of the bacterium termo. This method was called "bacterium-therapy," but it has

been abandoned. Whatever benefit it produced was due to the inhalation of the vapor of water. Moreover, it is well known that the tubercle-bacillus and the bacteria of decomposition and of pus all flourish together.

**Tuberculin.**—The one specific contribution which we possess is, and remains, the glycerin extract from the tubercle-bacillus obtained by Koch, and named by him tuberculin.

Opinions regarding the virtue of tuberculin still vary between the extremes. Clinicians in general are dissatisfied with the results, while the pure experimentalists in the laboratory continue to observe direct effects. Koch maintains in force all his original propositions concerning the virtue of tuberculin, and his immediate associates and assistants attribute the failures to complications.

Tuberculin is known to be a product of the growth of the tubercle-bacillus in a culture-soil of veal-broth containing 1 per cent. of peptone and 5 per cent. of glycerin. It is extracted with from 40 to 50 per cent. of glycerin, so that it keeps almost indefinitely. I have some of the first, furnished nearly four years ago. It still shows the same effect as that obtained last month; that is, in the dose of one milligram (1 per cent. solution), it excites its peculiar reaction in tuberculous patients.

Definite conclusions are obtained here, as elsewhere in the history of tuberculosis, from the field of ophthalmology. Donitz recorded the conclusion, from his observations, that tuberculin was capable of causing a certain cure in experimental tuberculosis of the eye of rabbits, unless extensive destructive lesions were present. He ascribed contrary views to improper methods of treatment. Departing from the method advised at first, Donitz recommended that an animal with beginning tuberculosis of the eye should be kept permanently under the marked reaction of tuberculin. He accomplished this result by beginning with tolerably large doses daily, which were gradually increased. In this way Donitz claimed to cure experimental eye-tuberculosis, if not too far advanced. He confessed, however, his incapacity to confer immunity, as well as to prevent the disease. Trudeau obtained nearly similar results from his use of the remedy. Pfuhl maintained that tuberculin acts upon tuberculosis of the liver and spleen in a curative way, but leaves the lungs unaffected, or unfavorably affected. Baumgarten thinks it more probable that tuberculosis of the liver and spleen had remained undeveloped, and that under the influence of tuberculin a more rapid and abundant colonization of bacilli occurred in the lungs. Pfuhl saw, as the chief value of treatment with tuberculin, the prolongation of the life of tuberculous animals. Kitasato's results coincide, in the main, with those of Pfuhl, save that in contradistinction to the latter he observed a retrogressive cicatrization of the tuberculosis also in the lungs of animals treated with tuberculin.

Buchner sums up existing knowledge upon the subject as follows:

Tuberculin belongs to the series of bacterio-proteins. It is obtained from pure cultures of the tubercle-bacillus by extraction with glycerin at high temperature, and shows chemically the properties of an albumose. All of the proteins of this class have the following effect:

1. They are chemotactic—that is, they attract leukocytes to the region in which they are introduced subcutaneously. After injection into the blood there results a general leukocytosis. This property has been demonstrated for tuberculin by Hueppe and Scholl, Dardach, Uskoff, and Tchistovitsch.

2. They induce formative irritation, cell-proliferation, and multiplication by division (Roemer). These processes have not been demonstrated for tuberculin, but they have been observed to follow after the injection of dead tubercle-bacilli by Prudden and Hodenpyl.

3. They cause excessive secretion of lymph (Gärtner and Roemer); and

4. Excite inflammation in man, locally at the seat of injection, or at the point of colonization of the tubercle-bacilli.

Any specificity of effect, in the sense first indicated by Koch, does not exist. Tuberculin cannot, therefore, confer specific immunity to tuberculosis. It rather irritates all the tissues, but this irritation may with cautious dosage be confined to the diseased centers. The proof of the non-specificity of tuberculin rests upon the fact that the same effects may be produced by the proteids of other bacteria, for instance, those of the bacillus pyocyaneus or the bacillus prodigiosus, on the one hand, and on the other by the fact that tuberculin may produce the same reactions with non-tuberculous processes—for instance, lepra, actinomycosis. It is probable, therefore, that tuberculin may be substituted by other non-pathogenic proteids (Klemperer).

That tuberculin can absolutely cure tuberculous processes has been demonstrated, partly by observations on man and partly by experiments on animals (Kitasato, Pfuhl). The *modus curandi* lies not in the injurious effect of the agent upon the bacilli, but, as the author first maintained and as is now universally believed, in the inflammatory irritation of the tissue about the tubercle, whereby death of the bacilli is effected. Necrosis and exfoliation of the tuberculous tissue may be effected only in superficial lesions, as in lupus, but the chief curative effect of tuberculin does not depend, as Koch maintained originally, upon necrosis. The fact is, there is rather an opposite condition produced—a temporary increase of the normal power of resistance in the irritated parts.

Aside from the possibility that the irritation thus artificially produced may sometimes be excessive and thus defeat its end, the failures in treatment with tuberculin depend, on the one hand, upon the universality of the irritation, which may thus develop unexpected and undesired inflammations in tissues not affected; while, upon the other hand, it has been noticed by many good observers that tuberculin has no effect upon the most recent miliary tuberculosis, and is not capable of checking the spread of this process. That tuberculin may, under proper circumstances, furnish most favorable results has been demonstrated by the later communications of Kaatzer, Schiess-Bey, and Kartulis (Egypt), and especially by the observations of Schaefer in the reformatories of Kaisheim.

Kaatzer reports that of 44 patients treated with tuberculin, 14 died, 16 were cured, 9 improved, 4 unimproved, while 1 remained under treatment.

Those cases only were considered cured in which the symptoms ceased without relapse and tubercle-bacilli permanently disappeared from the sputum. The percentage of cured was 34.6. The beginning dose was 0.0001 gram. The quantity of tuberculin used per person was 1.535 gram; the duration of treatment was from six to fifty-two weeks. Kaatzer considers tuberculin, under proper conditions, an innocent and effectual remedy. The cure is quicker than by any other known means, and it is brought about by an immunization of the tissues.

Thorner ascribes failures to improper use of the remedy, and declares that he has seen in cases of incipient tuberculosis a recession of all bad symptoms, an arrest of cough and expectoration, disappearance of bacilli, the greatest possible restoration of strength, improvement of appearance, and remarkable increase of weight. He begins treatment with 0.00005 gram and increases the dose by the same amount every forty-eight hours. When the patient, after a treatment of three months, has reached the dose of 0.0005 gram, each one of the next five injections is increased 0.0001 gram so that the patient reaches 0.001 gram in about four weeks. If fever has not disappeared by this time, the treatment is given up; otherwise the dose is now increased 0.0002 gram, and after five injections 0.0005 gram with but two injections per week. Thus after a treatment of nine and one-half weeks, the dose reaches 0.005 gram. This slow method is followed until a dose of 0.05 gram is reached. With the appearance of anemia or fever or marked loss of appetite during the treatment, the dose is reduced or the remedy is discontinued altogether.

As a therapeutic agent the value of tuberculin may now be definitely accepted. Its use is contraindicated in the presence of hectic and hemorrhage, and in serious affections of the intestinal canal—conditions due to sepsis and best controlled, if controllable at all, by creosote and cognac. Tuberculin addresses only pure tuberculosis. It is therefore of especial value in incipient cases of disease of the lung, before sepsis has set in, and in deep-seated or latent tuberculosis of gland or bone. Under these conditions it often puts a new phase upon the disease. Cases of anemia, amenorrhea, dyspepsia, cryptogenetic fevers, "colds," bronchial catarrh, so-called rheumatism (in reality beginning bone-caries), recurrent or obstinate laryngitis, or other of the multiform manifestations of tuberculosis, whose real nature was only disclosed perhaps by a diagnostic dose (1 milligram of a 1 per cent. solution) of tuberculin, gradually yield under the continued and judicious use of the

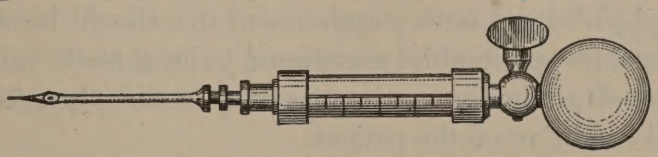

FIG. 17.—Koch's syringe.

remedy. The initial dose should be small, from 0.00005 to 0.0001 gram, and should be gradually increased (avoiding fever), slowly at first, more rapidly later, up to 0.1 gram. The remedy should be introduced subcutaneously —always with the Koch syringe (Fig. 17), which should be disinfected with

absolute alcohol before and after each injection—deeply under the skin of the back of the trunk, between or below the scapulæ, not oftener than every other day, and always in the morning, so that the effect upon the temperature, if there is any elevation, may be studied during the day.

From the point of view of diagnosis, statements also differ. In animals the injection of tuberculin always suffices to discover tuberculosis when present, so that the remedy is relied upon absolutely, as in the case of cattle. In man, however, as stated, the same reaction may sometimes be obtained in other and allied affections, as in lepra and actinomycosis. These diseases, however, do not come into practical consideration. In the separation of pneumonias, especially in cases characterized by an absence of expectoration, the use of tuberculin is invaluable. Thus, Wassermann speaks of the impossibility of making a diagnosis in cases of infiltration of the apex from the physical signs alone. In a case narrated the diagnosis was established only by the examination of the sputum, after several observations. In cases in which there is no expectoration the diagnosis may be established only by the injection of tuberculin. "Tuberculin gives an absolutely certain result if it be used in the right way." Springthorpe of Melbourne, a careful and competent observer, confirms this view. He stated that he had always found tuberculin reliable when used with discretion, and about two years later he declared that his subsequent experience but confirmed his belief in the soundness of his position.

Klein, working under Weichselbaum, found in his experiments upon animals that minute doses of tuberculin were absolutely unattended with any bad effects, and I can confirm this statement for man after a constant use of the remedy for three years.

Behring, the discoverer of the diphtheria-antitoxin, intimates the discovery of an antitoxin in the blood of individuals or animals treated for some time with tuberculin, and proposes to use this antituberculin in the cure of tuberculosis in man. He declares that the time is not far distant when the discovery of tuberculin will be hailed as a benefaction greater than that of the antitoxin of diphtheria, for the recognition of the toxin of tuberculosis is an absolute promise of the discovery of a cure for it.

I find it most convenient to prepare solutions of $\frac{1}{100}$ of 1 per cent. (0.0001) and of $\frac{1}{20}$ of 1 per cent. (0.0005). These two solutions, which are made with $\frac{1}{2}$ of 1 per cent. (0.005) carbolized water, are kept in dark bottles in small quantities. The treatment should begin with the use of one interspace of Koch's syringe of the $\frac{1}{100}$ of 1 per cent. solution, and this should be used not oftener than every other day—preferably, sometimes, twice a week—and the quantity should be increased gradually one interspace at a time, in accordance always with the general condition of the patient.

We may close this discussion of tuberculin with the statement that in the dose of 0.00005 gram the remedy is entirely free from danger, and employed in the proper cases, after the method described, is the most valuable of all the single methods of treatment of incipient tuberculosis.

**Nuclein, etc.**—G. Sée designates under the name of "nucleins" a series

of substances extracted from the cells of the pulp of the spleen and, more recently, from other cells. Nuclein is an albuminoid body which contains phosphoric acid. It is a colorless or yellowish powder, insoluble in water and alcohol, but soluble in alkalies. In a dose of from 2 to 3 grams it increases the number of colorless corpuscles of the blood almost to the degree of an actual leukocytosis, without any damage to the body. It is of great service in the diagnosis of latent tuberculosis. In subjects presenting no symptoms whatever the ingestion of 2 or 3 grams of nuclein excites an elevation of temperature up to 40° C. (104° F.) which may last two or three days. At the same time an examination of the chest reveals unusual physical signs, fine râles, etc. These symptoms are all transitory. Vaughan and Huber have experimented with the nucleins of yeast and spleen in the treatment of tuberculosis with as yet indefinite results.

Potassium cantharidinate, recommended by Liebreich, was abandoned almost as soon as it was essayed. It causes albuminuria, hematuria, and cystitis. Cantharidin provokes a serous exudation into the kidneys and lungs, and was employed in tuberculosis in very small doses, with a view of causing a transudation of serum about the diseased capillaries. To the absorption of this extravasated serum are attributed bactericidal results.

Inoculations of erysipelas have been practised in the hope of inducing effects similar to those sometimes observed in cases of carcinoma, but this hope has not been realized. Nannotti made an observation with Grazzi of a case of cure of tuberculous inflammation of the knee-joint under the influence of a spontaneously acquired and recurrent erysipelas. This observation led him to study the relation between tuberculosis and erysipelas. He made three sets of experiments on guinea-pigs and rabbits whereby he was enabled to demonstrate that there was no antagonistic influence between the erysipelas-coccus and the bacillus tuberculosis. The lack of any antagonistic relation between the bacteria of decomposition and the bacillus tuberculosis has already been referred to.

### Action upon the Bacillus and the Associated Bacteria.

**Creosote.**—Of all the remedies recommended in the treatment of pulmonary tuberculosis, the only one that holds its place and continues to grow in favor with clinicians is creosote. This remedy, in some form or other, was first used in pulmonary tuberculosis in the preparations of tar, recommended as long ago as 1817, by Sir A. Crichton, physician to the Empress of Russia, and by Morton, of Philadelphia, as early as 1834, as a treatment "with which nothing could compare." As is now known, creosote is the principal ingredient of tar.

Creosote (*κρέας*, flesh; Attic, *κρέως*; Doric, *κρῆς*, hence creosote, creasote, or cresote, *σώζειν*, to save) was separated by Reichenbach of Blankso, in 1832, from wood-tar, and received its name from the property of preserving meat from decomposition without rendering it unfit for nutrition. Two years later, Runge extracted carbolic acid from coal-tar. Gerhardt gave this product the

name phenol. The two substances were confounded until 1853, when Gorup-Besanez declared that the creosote extracted by Reichenbach from beechwood-tar was an entirely different body from carbolic acid, in that creosote consisted of a mixture of guaiacol and creosol, while carbolic acid is crystalline and contains but one atom of oxygen—hence it is not really an acid, but an alcohol, and should be known as phenyl-alcohol.

Forty-five years had elapsed since the discovery of creosote. The drug was widely, almost wildly, used, and then forgotten. From this oblivion it was rescued in 1877 by Bouchard and Gimbert, the real pioneers in this therapy, who ascribed to it great virtue in the treatment of pulmonary tuberculosis.

Sommerbrodt published a statistical essay on the use of creosote since 1887 in chronologic order, showing the gradual development in creosote-therapy. The most remarkable result is the increase in the daily dose, and the author confirms the statement originally expressed, that the more creosote is tolerated during the day the better is its effect. While the daily dose for an adult in former years reached a maximum of ½ gram (ℳviij), in later times the dose has been gradually increased to 4 (fʒj), even to 8 grams (fʒij) per day (in children from ½ to 1½ grams—ℳviij–ℳxxiv), not only without injury, but with the best effect. Cough and expectoration disappear. The undesirable use of morphin is rendered superfluous. Night-sweats cease; the appetite sometimes becomes enormous; the body-weight gains. The local lesions in the lungs disappear, or remain only as relics. Even in the grave, apparently hopeless cases, remarkable, though of course only temporary, results are accomplished. While the author formerly "in small doses saw only essential improvement, later, with large doses, he has been able to accomplish cures—and that, too, not only in lung-tuberculosis, but also in surgical tuberculosis and in scrofula."

The clinical proof of the effect of the remedy in tuberculosis is the influence on the fever. Creosote has no real influence on the fever. I have tested this fact in every way. Though the patient be saturated with the drug by every avenue—by the stomach, by the lungs, by the bowel, by the skin, by all these methods at once—creosote does not control the fever. Thus there is no specific influence, and no real, that is no radical or direct, cure. Albu gave creosote in doses of over 4 grams (fʒj) a day. The result of this excessive dosage was not curative of tuberculosis, especially of the pulmonary variety. For most cases creosote is a good expectorant; for others a stomachic, and in general it gives the impression of a tonic; but the most extensive experiments demonstrate that the sputum of tuberculous patients, even after the most abundant use of creosote, still shows virulent bacilli.

But if creosote can cure indirectly, or if it will only relieve complications, it will hold its place in therapy until something better is found. Sommerbrodt says that though a scientific explanation is still lacking, he believes that creosote alters the tissue of the cells and the chemic condition of the juices of the body, so that they no longer furnish a suitable culture-soil for the tubercle-bacilli, the colonies of which will not grow in it.

Ludwig maintains that creosote destroys the toxin of the tubercle-bacillus. This is a fine theory, but is not demonstrable at present. After the injections, catarrhal lesions of the apices will, he says, show no bacilli. The caseous will soon assume the mucoid form, which seems to exercise a toxic effect on the microbe.

According to Peter, injections of guaiacol and creosote act by substituting a fugitive and curable hyperemia for a tuberculous hyperemia. Under the use of the latter drug, cough and expectoration diminish; fever and night-sweats cease; appetite returns, and the patient gains in weight and strength. The benefit is due to the elimination of the drug by the lungs. It excites a simple and transitory inflammation, in place of a specific catarrh.

Dujardin-Beaumetz, indeed, declares that creosote in appreciable dose congests the bronchial mucous membrane and promotes hemorrhage, while Guiter claims that the drug acts as an irritant which favors cicatricial sclerosis. Finally, Peter believes that creosote is more useful in protecting healthy tissues than in curing those that are already invaded. All these views are theories not demonstrable by clinical proof.

That creosote acts upon the stomach has been demonstrated by Walche, Hopmann, and Klemperer. It excites the appetite and lessens the distress of indigestion. In fact, this action is first observed. Most patients improve decidedly for a time under the immediate change of nutrition. And this action is well understood. For, according to Brunton, while 1 part of chlorin in 8540 parts of a saturated solution will arrest the digestive action of ptyalin upon starch-paste, and corrosive sublimate is so enormously destructive as to arrest its action even in 1 part to 51,000, creosote has no action on ptyalin, even in saturated solution, and has but a very feeble action upon pepsin.

Can it be that creosote is destructive to the associated micro-organisms? Upon this subject there is less definite knowledge. Marfan declares that creosote has an action more energetic on the micro-organisms of secondary infection than on the bacillus tuberculosis itself. From this point of view it is, he says, "the most puissant of the balsams." Under its influence, the cough diminishes, and the expectoration and the râles become less abundant. Sternberg found creosote fatal to micrococci in general in the proportion of 1 to 200.

Creosote was found by Wernecke to destroy yeast in a dilution of 1 part to 500 of water, and by Buchholtz to kill ordinary bacteria in a dilution of 1 part to 1000 of water. This difference, according to Brunton, enables us to arrest fermentation in the stomach depending upon the presence of low organisms, while the digestive action of pepsin is not, or is only very slightly, disturbed.

It is not likely that creosote neutralizes or destroys the streptococcus itself, because it shows no real effect upon the fever. But it certainly does inhibit the growth, or actually destroys some, of the organisms which induce fermentation in the stomach and intestine, without interfering with the processes of digestion; and this is the actual knowledge in hand at the present time regard-

ing the action of the drug. Thus creosote contributes to the cure of pulmonary tuberculosis as do arsenic, hydrochloric acid, sodium benzoate, etc., through the avenue of nutrition.

Guttmann found that in solution of 1 : 4000 creosote exercised a marked inhibitory action on the growth of tubercle-bacilli, and in solution of 1 : 2000 actually destroyed them. Guttmann's experiments were made out of the body, but deductions could not be drawn from them in the body because the concentrations were too great. In order to secure a proportion of 1 : 4000, a concentration which hinders the growth of tubercle-bacilli, more than 1 gram of creosote would have to circulate in the blood.

Cornet showed that large quantities of creosote in the stomach did not prevent the development of the tubercle-bacillus in guinea-pigs. In the proportion of 1 : 100 it fails, after twenty-four hours' exposure, to destroy tubercle-bacilli in sputum. A saturated aqueous solution does not destroy the tubercle-bacillus in cultures in twelve hours (Sternberg).

In Trudeau's experiments, rabbits inoculated with tuberculosis, and treated with creosote subcutaneously, presented the same lesions as control-animals not so treated.

Bouchard deduced from his experiments that 3.50 grams, about 1 dram, of creosote would suffice to destroy bacilli in the middle of the body of a man weighing 60 kilograms (135 pounds), but Burlureaux injected into tuberculous patients as much as 40 grams of creosote a day—under which dosage, according to Bouchard, all of these bacilli should have been killed and the patient ought to have recovered. But these results did not occur.

Coze and Simon tested the efficacy of creosote in animals, and found that the injection of creosote prevented in guinea-pigs the development of a general tuberculosis. Cornet, on the other hand, found that the injection of 0.02 (♏⅓) of creosote into the stomach by means of a tube did not protect these animals from infection with tuberculosis.

Friedheim, too, found that treatment with creosote did not prevent the development of tubercle-bacilli introduced into the bodies of animals.

Albu's experiments show that tuberculous sputum taken from bodies saturated with creosote maintains its virulence. He injected such sputum into the anterior chamber of the eyes of rabbits, and the course of the disease was perfectly typical. By the nineteenth day the first colonies of tubercle-bacilli were visible under the lens. Subsequent changes ensued in the course of time. Only one animal showed miliary tuberculosis. In a second series of experiments, such sputum was injected into the peritoneal cavity of guinea-pigs. The peritoneum showed virulent material in six weeks. Hence, the drug exerts no specific influence.

Although the mode of action of creosote has not been determined, there is no doubt about the clinical value of the remedy. In this connection Sommerbrodt cites the statement of Kirchhoff, that when theory and practice do not agree practice is always right. Weiss observed in his cases increase of weight, decrease of cough, and increase of appetite. In fact, the increase of appetite

is striking. The appetite may actually become ravenous, and this change is observed not only in cases of slight involvement of the apices, but also in those in which the disease is advanced. Patients who have had no appetite for weeks find that it returns in the course of a few days after the administration of creosote.

Cases marked by the absence of fever, with more or less complete anorexia, are the most benefited, but creosote often exercises a good effect even in the latest course of the disease and in the presence of intermittent fever. When it actually does interfere with the appetite it should be withheld at once; and the remedy is contraindicated when there is diarrhea or disease of the kidneys. The urine should therefore be examined during the course of treatment with creosote.

Creosote distinctly checks excessive secretion from the lungs and exercises a directly favorable effect upon the stomach; therefore there must be also an indirectly favorable effect upon the lung. The majority of practitioners will therefore subscribe to the judgment of Weyl, that creosote is the best remedy we have in the symptomatic treatment of pulmonary tuberculosis (Weiss).

Creosote may be given in gelatin capsules, 0.1 (℥iss) of creosote, with cod-liver oil. Pure creosote in liquid form is cheaper. Sommerbrodt used the preparation of Hartmann & Hauers, of Hanover. Most of us in this country use that of Merck or of Morson. The remedy may be given in a mixture of two parts of tincture of gentian in milk or wine. It should never be taken on an empty stomach, and is best given immediately after the three chief meals. It never hurts the stomach. It increases menstruation; consequently it should be withheld or given guardedly during that period. It may be continued for years, and must be continued long after apparent cure. Its action is, of course, much assisted by climate, altitude, lung-gymnastics, good nourishment, but it does good often even under the most unfavorable surroundings, and not infrequently in apparently desperate cases.

Vopelius declares that the better creosote is tolerated the more beneficial is the effect. He gave it in doses up to the point of tolerance, and found the improvement in correspondence. The appetite increased, and with it the weight. He gives it uniformly, beginning with a daily dose of 2 grams (℥xxx), and increasing it up to 4, 5, 6, and 8 grams (ʒj, ℥lxxv, ʒiss, ʒij) a day. He gives it together with tincture of gentian in equal parts, in a large amount of milk, as an emulsion. On shaking it with milk it becomes so finely subdivided that it no longer burns or irritates the mucous membrane; on the contrary, it rather stimulates the stomach to secretion. Vopelius gave it also in tuberculosis of the bones and joints in connection with local treatment.

The remedy has been administered by the stomach, by the rectum, by inhalation, and by the skin. Through the rectum it has been given systematically by Revillet according to the following formula: Water, 200 grams (fʒvjss); creosote, pure, from 2 to 4 grams (fʒss–fʒj); oil of sweet almonds, 25 grams (fʒvj); yolk of egg, No. 1. The creosote is first dissolved in the oil, and subsequently emulsified with the yolk of egg. There results a homogenous liquid of the

appearance of milk, and with a yellow color. The emulsion may be made still finer by the addition of some gum. The oil of sweet almonds is preferred because it does not produce colic, and because it contains matters that act as adjuvants in alimentation. The injection is given preferably in the evening, as it is best retained at night. The signs of absorption show themselves rapidly. The patient instantly experiences the taste of creosote in the mouth, and the urine may assume a greenish-black color.

Creosote is given by injection by Grasset in the following proportions:

℞ Tincturæ opii, 3.0 (ℳxlv);
Creosoti, 30.0 (f℥j);
Olei olivæ, 300.0 (f℥x).—M.
S. A teaspoonful rubbed up to an emulsion with the yolk of one egg and 100 grams (f℥iii$\frac{1}{3}$) of water, morning and evening, by injection.

Creosote was injected through the thoracic walls into the apices of the lungs by Lépine and Truc of Lyons, and by Gougenheim of Paris, without any particular result.

The first idea of subcutaneous injection was entertained in 1875 by Bouchard. Du Castel in 1882 injected peptonized creosote subcutaneously, but the introduction of the treatment is really due to Gimbert, in 1886. He was soon followed by Burlureaux. Gimbert injected a solution of creosote 1 gram (ℳxv) to 14 grams (f℥iiiss) of the oil of sweet almonds, drop by drop, intermitting occasionally to avoid pain. Gimbert injected only from 15 to 22 grams (f℥iv–f℥vj) of the creosotized oil, that is to say, from 1 to 1.50 grams (ℳxv–xxij) of creosote. Burlureaux injected on an average 50 grams, *i. e.*, over an ounce and a half, a day, and he even exceeded this dose and made daily injections of 100 (f℥iii$\frac{1}{3}$), 180 (f℥vj), 200 (f℥vi$\frac{2}{4}$), and even 220 grams (f℥vii$\frac{1}{3}$), in order to saturate the organism. The remedy is really harmless.

According to Burlureaux, who treated 400 patients in this way, when tolerance ceases the prognosis is dubious, and the patients are lost. If the patient perceives the taste of creosote for a long time, if his urine becomes black, if he has vertigo, torpor, and sweats, recovery is despaired of. Sweating frequently occurs at the beginning of the treatment, sometimes immediately in consequence of the injection. It is occasionally profuse, and may last seven or eight hours. It has no great significance, and does not indicate intolerance. It is rare that it occurs alone; more often it is accompanied by fever, sometimes by chill, with headache and coldness. The extremities may become icy cold and there may be the picture of the algid form of pernicious fever. The sweating does not last longer than three-quarters of an hour, and is followed by a state of *bien être.* The dose in these cases has been excessive, and should be reduced.

The virtue of creosote depends upon its purity, especially upon its freedom from carbolic acid and pyrogallol. Many preparations called official are impure. Pure creosote has an oleaginous appearance, a strong resinous odor,

a caustic taste, is slightly soluble in water, very soluble in alcohol and the oils. It should be nearly clear or show but a slight amber tint. It varies in composition according to the substances from which it is distilled. The following substances are found it it:

| | | | | |
|---|---|---|---|---|
| Phenic acid, | passing | at a | distillation of | 182° F. (83.3° C.); |
| Guaiacol, | " | " | " | 200° F. (93.3° C.); |
| Cresol, | " | " | " | 203° F. (95° C.); |
| Creosol, | " | " | " | 217° F. (102.8° C.); |
| Phlorol, | " | " | " | 220° F. (104.4° C.). |

To obtain uniform results the temperature of distillation is fixed at from 200° to 210° F. (93.3°–98.9° C.). At this range the major part is guaiacol, boiling at 200° F. (93.3° C.). United with cresol and a small quantity of creosol, this forms a liquid having a density of 1067, and giving with neutral ferric chlorid a green color.

According to Vigier, creosote owes its effect not to any single chemically defined substance, but to a mixture containing creosol, and especially guaiacol, also derivatives of pyrogallol, which last substance is toxic. Guaiacol, which is the active principle of creosote, according to Picot, Lépine, and others, is more readily tolerated than creosote, but it is seldom found pure in commerce. Impure creosote, which contains carbolic acid, irritates the mucous membrane of the stomach and intestines, and produces local inflammation. Some of the contradictory testimony regarding the remedy is thus explained.

The purity of creosote is determined (1) by its specific gravity, which should not be under 1070 (Brandes); (2) by the demonstration of the presence of phenol; the addition of one drop of a solution of ferric chlorid to a watery solution of creosote should give only a green, and never a blue, color.

The uncertainty of the drug in former, and even in recent use, is illustrated by the statement of Oertel[1] that creosote acts like carbolic acid, but as the composition of creosote is so uncertain, it is better substituted by carbolic acid. Dagivait, indeed, maintains that failures are due to impurities. He published a communication on "Impure Creosote the Cause of Failure in the Treatment of Pulmonary Tuberculosis."

Bouchard found that it required 17 c.cm. of carbolic acid per kilogram to kill a rabbit. By subcutaneous injections of an oleaginous solution of creosote, it required a dose nineteen times as strong. One may, without danger, inject every day in a rabbit 25 c.cm. per kilogram in an oleaginous solution. This daily dose, which is without danger to an animal, is equivalent to 15 grams given to a man weighing 60 kilograms, *i. e.* f℥ss to 140 pounds. A non-fatal dose produces as a sole phenomenon in animals a retardation of respiration. The number falls from 80 to 16 in the minute; long and anxious pauses occur. Bouchard first remarked upon this retardation of respiration in man. The only case of poisoning by creosote in the literature is reported by Freudenthal

[1] *Handbuch der allgemeinen Therapie*, 1882.

(1892). A woman, thirty years old, who had been taking from 2 to 3 grams (ℳxxx–xlv) of creosote for months, took within two hours about 10 grams (fʒiiss) in solution. She was found unconscious, showing exquisite trismus, cyanosis of the lips, contracted pupils with insensibility to light, and tracheal râles. It seemed as if the patient must succumb. In the course of nine hours, however, consciousness began to return; whereupon the bad symptoms rapidly disappeared, and the patient recovered without any evil effects.

On the other hand, Friedheim found that creosote had toxic properties in animals, and that rabbits and guinea-pigs treated for weeks with from 2 to 9 grams (ℳxxx–fʒiiss) of creosote were affected with paralysis and convulsions and fell into fatal syncope. The autopsy revealed infiltration and circumscribed necrosis in the lungs, liver, spleen, and kidneys. Further, there were found lobular pneumonia, inflammatory processes in the kidneys, infiltration and ulceration of the intestinal mucous membrane, with the deposit of blood-crystals and petechial hemorrhages.

Considered only from a clinical standpoint, creosote holds its place. Its administration is an easy routine practice, and the drug is really, as shown, perfectly harmless in any dose. In my wards at the Good Samaritan Hospital all patients with pulmonary tuberculosis are put upon creosote immediately upon entrance. We begin with five drops of a mixture of creosote and tincture of nux vomica, or, when strychnin is contraindicated, tincture of gentian, in a teaspoonful of whisky and a tablespoonful of water three times a day after meals, increasing the dose a drop daily to twenty, and increasing the whisky and water in the same proportion. The body shows signs of saturation at from sixty to ninety drops per day. Six cases were treated also hypodermically with the same dosage, but without any appreciable advantage over the internal treatment alone. Four bad cases with marked hectic, and forty lighter cases without hectic, were treated, in addition, with inhalations in the pneumatic cabinet, and this or a similar method has been tried thoroughly in France; but, aside from the psychic effect, with no special benefit. We give the remedy by the rectum only in the very exceptional cases in which it is distasteful to repugnance by the mouth.

All our cases in non-febrile periods are treated also with tuberculin, which remains the only radical address to the cause of tuberculosis, but which has, as stated, no effect or only a bad effect upon the streptococcous infection.

*Conclusions.*—1. Creosote when pure is harmless.

2. It has no direct action upon the tubercle-bacillus.

3. Tuberculosis pulmonum is chiefly a secondary infection by the streptococcus.

4. Creosote has no direct action upon the streptococcus; hence none whatever upon hectic fever.

5. It destroys lower organisms, especially those that induce fermentation, without affecting the process of digestion.

6. Hence the virtue of creosote, which is undeniable, is chiefly but not wholly nutritional; all the rest is speculation.

Chaumier prefers creosote carbonate, which contains 92 per cent. of creosote and is less irritating to the stomach. It may therefore be given in large doses —from one to four dessertspoonfuls.

**Guaiacol.**—The instability of creosote led to the substitution for it of guaiacol. Guaiacol was first isolated by Saint-Claire Deville in the distillation of the resin of guaiac. It is one of the principal constituents of rectified creosote. It is employed by many observers in the place of creosote and in the same way; often by subcutaneous injection, sometimes in combination with iodoform. Marfan observed in the service of Peter a number of cases treated in this way. The results did not justify the expectations. Many patients experienced after each injection general malaise, and were covered with abundant sweat. Guaiacol did not prove superior to creosote. Seifert and Hölscher proposed to use guaiacol carbonate in the form of powder up to six grams (ʒiss) a day. Walzer suggested the use of benzol-guaiacol, a crystalline product of the combination of benzoic acid and guaiacol, given in the form of powder up to three grams (gr. xlv) a day. Haas advised styracol, a cinnamic ether of guaiacol. These three products have the advantage of being tasteless, and of being well tolerated by the stomach. In my experience no form of guaiacol is as good as creosote, chemically pure.

De Grazia Casaretti treated cases of pulmonary tuberculosis with derivatives of creosote, to wit, with benzosol and guaiacol, guaiacol carbonate, guaiacol, carbonic acid, creosote carbonate. All of these preparations were well tolerated, but even a long-continued use of the remedies produced no essential benefit. Benzosol was the only drug that seemed to bring about a diminution in the catarrhal symptoms. No reduction in the number of tubercle-bacilli could be observed in any case.

Venturini[1] injected dead cultures of tubercle-bacilli into guinea-pigs. As is well known, a few milligrams of such cultures suffice to kill guinea-pigs under a slow marasmus produced by the poisonous products of the bacilli. In order to test any antidotal properties of iodoform and guaiacol, these agents were injected in various proportions with every ten milligrams of sterilized tubercle-culture, and the duration of life of the animals thus treated was compared with the duration of the life of control-animals injected with the tubercle-culture without the medicaments. The experiments show that neither iodoform nor guaiacol had any attenuating influence on the toxic products of tubercle-cultures—neither when injected simultaneously in the same spot nor if previously mixed with the culture and allowed to stand with it for hours before the injection.

Wyss of Zurich says that cases of poisoning by guaiacol have been only very rarely reported.

Kobert in his work on *The Intoxications* states that after doses of 1 gram (gr. xv) mild symptoms of intoxication occur, such as burning in the stomach, nausea, and hebetude; but that even after the administration of fifteen grams (ʒiv), in a case in the medical clinic at Dorpat, thanks to a quick irrigation of

[1] *Lo Sperimentale*, July 15, 1893.

the stomach, death did not occur, though there were loss of consciousness, dilatation of the pupils, irregular breathing, and an intensely dark discoloration of the urine, which was free from albumin but had the appearance observed after poisoning with carbolic acid.

Wyss has reported a case that ended fatally in spite of irrigation of the stomach, and found glossitis, pharyngitis, gastritis, enteritis, a large splenic tumor, beginning parenchymatous degeneration of the liver, icterus, acute hemorrhagic nephritis, with hematuria and hemoglobinuria, dilatation of the heart, with parenchymatous degeneration of the myocardium and ecchymoses in the pleura, pericardium, endocardium, and peritoneum.

**Volatile Essences and Balsams.**—The antiseptic properties of volatile essences have been known since antiquity. These agents introduced into the body are eliminated by the organs of respiration, and the supposition that they would have a favorable action on tuberculosis was confirmed by the researches of Freudenreich, who found that twenty drops of the following essences placed in a culture-tube checked the germination of the bacillus tuberculosis: canella, wintergreen, rosemary, peppermint, origanum, thyme, geranium, lavender, angelica, eucalyptus (Marfan).

These essences are in general not well borne by the stomach; nevertheless certain physicians prescribe the essence of peppermint in capsules. Sée gives terpin, Eichhorst myrtol. I have reported some experiments with the oil of garlic.

Roussel of Geneva advocates the subcutaneous injection of eucalyptol dissolved in vegetable oil or liquid vaselin. The daily dose should be from 0.25 to 0.50 (gr. iv to gr. viiss). The same author advises the essence of eucalyptus by inhalation. Daremberg contents himself with vapors of the essence of canella in the room. Delthil has the patient inhale several times a day, for from fifteen to twenty minutes, from a large bottle containing about a quart of the following mixture:

| | |
|---|---|
| Essence of turpentine, | 350 grams (f℥xiss); |
| Essence of aspic, | 100 grams (f℥iii⅓); |
| Iodoform, or iodol, | 8 to 10 grams (ʒij–ʒiiss); |
| Sulphuric ether, | 20 grams (fʒv). |

Onimus vaporizes the essence of thyme over an alcohol-lamp from an incandescent plate, whereby he disengages a certain quantity of ozone. The apparatus of Onimus placed in a sick-room suppresses with rapidity every bad odor.

Braddon employs inhalations of the essence of peppermint; and Rosenberg menthol, a product of the essence of peppermint of Japan. Menthol has been administered internally in a daily dose of from ten to fifteen centigrams (gr. iss–ii¼), by intra-tracheal injection in an oleaginous solution of 1 : 5, by inhalation and by intra-pulmonary injection. Denison devised an inhaler for these and similar volatile oils. In the Berlin Institute for Infectious Diseases

advanced septic cases were caused to inhale more or less continuously camphor dissolved in acetic ether, 1 : 10. This inhalation acts as a soothing and anodyne expectorant.

**Peppermint.**—Carasso, director of the Military Lazaretto of Genoa, claims to have cured 48 cases of pulmonary tuberculosis by means of inhalations of peppermint in conjunction with the internal administration of essence of peppermint and creosote. He laments the failure of other remedies, including tuberculin, and claims that the use of beechwood-creosote is attended with better results than that of any other means, but creosote is of advantage only in the first stage of the disease.

Based upon a number of scientific works that have demonstrated the antimycotic action of mentha piperita and upon the favorable results obtained by Leonard Braddon[1] by means of inhalation of this remedy in various stages of pulmonary tuberculosis, showing disappearance of the bacilli from the sputum and of every physical sign of the disease, the author has made systematic use of the remedy from the year 1888 up to the present time. His method consists in continued inhalation by day and night of mentha piperita associated with the administration of an alcoholic solution of beechwood-creosote with glycerin and chloroform, to which is added 1 per cent. of mentha piperita. Under the use of this method every case of pulmonary tuberculosis, whether in the first stage or in advanced stages, Carasso claims has been cured. Cases with numerous and extensive cavities and a great number of bacilli in the sputum were included in this category. In every case the bacilli disappeared from the sputum in a minimum period of thirteen days and a maximum of sixty days. As a consequence the cough and expectoration were markedly diminished, night-sweats ceased, and there was decided increase of appetite. Normal resonance was gradually restored to the affected part of the lungs and the vesicular murmur reinstated itself. There gradually occurred, therefore, a perfect *restitutio ad integrum*, a condition that the pathologists of the present day regard as possible. Fever disappeared in the course of a few days.

These almost incredible results were obtained in no fewer than 48 cases, and in every stage of the disease, provided only the disease was limited to the lungs, but not in cases in which the disease had extended to other organs.

Subsequent observers have, unfortunately, not been able to verify these results. I have tried the treatment faithfully at the Good Samaritan Hospital in ten cases, and abandoned it as worthless.

Rotmann subjected 17 patients to the method of treatment of Carasso, following the suggestions in the minutest detail. The period of treatment lasted from thirteen to one hundred and twenty-five days. In no single case did the bacilli disappear from the sputum, and in no single case was there any decided result obtained in any way. Rotmann concludes that either Italian tubercle-bacilli are less refractory, or that Italians are more susceptible to the influence of peppermint-therapy.

**Ichthyol.**—Cohn came to the idea of using ammonium sulphichthyolate on

[1] *Lancet*, London, March, 1888.

account of its anti-bacterial properties and its favorable influence on digestion, and was agreeably surprised with the effect. He used the drug in a hundred cases, and, during the whole time, somewhat over two years, saw only good effects. On account of cheapness and facility of absorption, Cohn orders the remedy as follows:

℞ Ichthyol,
Aquæ destillatæ, āā 20 (ʒv).—M.

The patient begins with 4 drops three times daily, and increases to 40 drops. Children between five and twelve years of age take half this dose. The remedy is best taken before meals, followed by a draft of black coffee to disguise the bad taste. Some patients could take the medicine only in the morning after breakfast. Patients soon become accustomed to the bad taste. The increase of dosage should be made by one drop a day and in a larger quantity of water, that is, in a wineglassful or half a tumblerful for the whole quantity. For the better class of patients the remedy may be given in pills and by inhalation, but the efficacy of pills is much less than that of the solution. Eructations, of which patients complain in the beginning, occur after the pill just as after the watery solution.

I have made faithful trials of this remedy in six cases, and found it of far less value than creosote.

**Cinnamic Acid.**—More rational, in theory at least, is the use of remedies in an endeavor to bring about the changes that lead to natural cure. Tubercles show but little change into fat, which represents a stage in the natural process of resolution. Tubercles are more frequently encapsulated in firm masses of connective tissue. This process interferes with the interchange necessary to the life and development of the tubercle-bacillus. The merit of having first employed cinnamic acid in the treatment of pulmonary tuberculosis belongs undoubtedly to Landerer, who set himself to work to induce artificial processes that should imitate those of the natural cure, that is, the conversion of a tissue poor in blood-vessels and showing a tendency to caseation into a tissue rich in blood-vessels with a tendency to the formation of granulations and scar-tissue. He sought a method of inducing an aseptic inflammation about the tuberculous mass, and used first for this purpose the balsam of Peru, introducing the remedy directly into the veins. In rabbits he was thus able to bring about a disappearance of the bacilli, a shrinkage and calcification of the caseous masses, and vicarious emphysema. The clinical results were also encouraging, but were later surpassed by the intravenous injection of cinnamic acid, the essential ingredient of balsam of Peru.

The best preparation for intravenous injection in the treatment of tuberculosis of the lungs is an aqueous 5 per cent. solution of sodium cinnamate sterilized for five minutes in a water-bath before use. The syringe is cleansed by filling it with absolute alcohol just before and after use.

An elastic band is fixed about the arm, not too tightly, about as for vene-

section. The elbow or the region of the cephalic vein is rubbed clean with cotton saturated with ether, whereby the veins appear more prominent. The alkalinity of the preparation is tested with red litmus-paper. While the elbow is held in over-extension the cannula is introduced into the vein parallel with the long axis. The instrument is known to be introduced into the vein by the feeling of emptiness; that is, the cannula is felt in a free space. The fluid is introduced easily and the instrument is immediately withdrawn; no swelling is left. The puncture is covered with a piece of sterilized or sublimated gauze, which may then be secured by a bandage. The bandage may be removed in the course of an hour; the elastic bandage is removed in from one to two minutes. The intravenous injection is painless, although sometimes it causes slight burning, which disappears with the removal of the elastic bandage.

There are no immediate consequences of the injection. Any feeling of oppression indicates that the dose was too large. Nervous people sometimes feel oppression even without any injection into the veins.

Gluteal injections are executed in the same way as with mercury. The upper posterior portions of the gluteal region are selected by preference as places where the flesh is thickest. One should avoid the region of the sciatic nerve and the gluteal vessels. The site of injection should be cleansed with ether and afterward covered with a piece of adhesive plaster.

The dose must be regulated according to the strength of the patient. The weaker the patient, the more extensive the process in the lungs, the smaller the dose. Under all circumstances the dose should be small at the outset: one-half an interspace of the Pravaz syringe. In very grave cases with doubtful prognosis the remedy should be diluted with a 0.07 per cent. solution of common salt. Sudden increase of dosage is to be avoided, and half an interspace or a whole interspace at a time always suffices. In most patients a dose of from 0.25 to 0.4 c.cm. (♏iv–viss) is enough. Strong patients may take exceptionally as much as 0.8 or 0.9 c.cm. (♏xiij–xv). In advanced cases the dose should remain at 0.1 or 0.15 c.cm. (♏iss–iiss). If a patient complains after the injection of pains in the head and chest, or of discomfort, the dose should be reduced. The injection is usually made twice a week. The best results are commonly obtained after injection every other day of small quantities, from 0.1 to 0.2 c.cm. (♏iss–iij). Severe disturbances, oppression, chilly sensations, are always signs of too great dosage or improper preparation, insufficient alkalinization, etc. With the proper precautions, the treatment can be so carried out that the patient never feels any bad effect. The duration of treatment in the lightest cases should be about three months. It should be continued four weeks after the disappearance of bacilli from the sputum. Advanced cases require nine months or longer.

Cinnamic acid and its salts act in a high degree chemotactically. Two hours after the intravenous injection of cinnamic acid in rabbits there occurs an increase of the colorless blood-corpuscles, of the polynuclear and of the so-called eosinophile cells, which reaches its acme in eight hours, with from a two-fold

to a two-and-one-half-fold increase in the cells, and ceases in twenty-four hours. There now develops about the tuberculous mass an aseptic inflammation, manifest in a dilatation of the blood-vessels, abundant migration of leukocytes, and marked serous saturation. As early as the third week a wall of leukocytes is formed about the tuberculous mass which encapsulates this. Simultaneously there occurs an emigration of leukocytes into the necrotic tissue of the tubercle. This process is followed by the penetration of the mass by young blood-vessels, the formation of young connective tissue, and besides by the leukocytes with spindle-shaped and epithelioid cells; finally the tubercle shrinks and is replaced by fibrillar connective tissue. There thus occurs an interstitial pneumonia. The alveolar septa are penetrated by leukocytes, and later thickened three-fold by fibrillar connective tissue. In man there occurs, besides this shrinkage, also calcification. The bacilli are but little influenced in the first months. They are at first stained with more difficulty, and finally disappear entirely.

Of fifty cases of internal tuberculosis thus treated at the time of the report, twenty-nine, *i.e.* 58 per cent., were cured; ten, or 20 per cent., were improved; two, or 4 per cent., were unimproved; nine, or 18 per cent., died. These cases were taken as they came, without reference to the stage of the disease. All of the cases that presented only infiltration without great disturbance on coming under observation were cured, including those that showed only moderate fever. Of the patients with cavities a part were improved, that is the surrounding infiltration disappeared, the cavities became smaller and the sputum free of bacilli; the other cases were unimproved or died. Patients with tuberculosis florida, especially young patients, with two exceptions, died. Of these exceptions, one recovered, whilst the other improved. Of surgical tuberculosis, there were nineteen cases of coxitis, five with suppuration, of which one died, and four recovered; fourteen without suppuration, of which twelve recovered and two were improved. There were nineteen cases of fungous disease of the foot, of which fifteen recovered and one remained uncured; of four without suppuration all recovered. Two cases with spondylitis both improved. Three cases of disease of the shoulder, with suppuration, were all cured; of four cases of disease of the elbow one died, two were cured, one was improved; of five cases of disease of the hand and finger, all were cured; of four cases of disease of the ribs with suppuration all were cured; of three cases of disease of the skull all were cured; of four cases of disease of the symphysis all were very much improved; twenty-four cases of disease of the glands were cured; of sixteen cases of lupus, ten were cured and six improved.

Most unfavorable are the cases in which tubercle-bacilli are entirely or nearly entirely absent, but in which streptococci, staphylococci, and pneumococci abound.

Eichler remarked that he saw good effects in the lighter and average cases, but none in the severer cases.

Schwartz reported himself as a patient cured in this way. He had received

fifty injections and had never experienced any evil consequences except a slight discomfort after individual injections.

In the wards of the Good Samaritan Hospital we made trial of sodium cinnamate, with all the precautions suggested, in six cases for two months. We were able to confirm everything that was said about the simplicity, ease, and innocence of the operation, but the results were disappointing. In two cases of tuberculosis incipiens the patients improved for a time. Over the confirmed cases the remedy seemed to have no control whatever, and its use was entirely abandoned at the end of three months.

Lannelongue tried a somewhat similar method in the treatment of surgical tuberculosis; that is, he attempted to induce sclerosis in tuberculous masses in the skin and bones by means of injections of *zinc chlorid.* A few hours after the injection there occurred in the tissues an afflux of new tissue-elements, partly from the migration of colorless blood-cells, partly from the proliferation of fixed tissue-elements. The cells infiltrate the periphery of the tuberculous mass, also penetrate somewhat and surround the tissue with a fibrous wall. There is thus produced a fibrous barrier which completely isolates the diseased tissue. Two tuberculous infants were treated in this way, two drops of a solution of zinc chlorid 1 : 40 being injected into the lungs through the second intercostal space. The injection produced only a little cough.

**Carbonic-acid Gas.**—Weber states that he published his first cases in 1889, and they received no consideration, because of the excitement then prevalent regarding the action of tuberculin. This author believes that the tissues are protected against the invasion of micro-organisms by chemic peculiarities. Thus the lungs are protected against the bacillus tuberculosis by the presence of carbonic-acid gas.

It is a well-known fact that patients affected with diabetes are ready victims to pulmonary tuberculosis. According to Ebstein, there is in diabetes a defective development of carbonic-acid gas. Pulmonary tuberculosis is especially brought to a standstill in pregnancy, on account of the contribution of carbonic-acid gas made by the fetus. With the expulsion of the fetus the increased production of carbonic-acid gas ceases, and the tubercle-bacillus exuberates in luxurious growth.

As Traube showed long ago, patients with diseases of the heart that induce hyperemia of the lungs, that is, an inundation of carbonic-acid gas, enjoy a certain immunity to pulmonary tuberculosis. The same exemption prevails in emphysema. Patients also with deformed thoraces—hunchbacks—are decidedly protected against tuberculosis of the lungs. The reason for this is not to be found in the limited expansion, but in the fact that the same amount of carbonic-acid gas is distributed over a smaller surface. Workers about lime-ovens enjoy also a distinct immunity to pulmonary tuberculosis for the same reason. Traube therefore proposed to treat the disease by the development of carbonic-acid gas in the stomach, for the production of which he gives first a glass of water containing twelve drops of hydrochloric acid, and follows with a teaspoonful of

sodium bicarbonate. These medicaments are taken half an hour before the first breakfast, before dinner, and before supper, thus upon an empty stomach. The hydrochloric acid is given in order that the sodium bicarbonate may not rob the blood and the stomach of the acid.

The majority of patients thus treated, though the disease was advanced so far as to be considered hopeless, felt themselves improved after a short time, and agreed that respiration had become easier and freer; also the appetite improved and the cough became less. But the time required for perfect recovery was very long, and it was only after the course of several years that the treatment could be stopped. The patients themselves expressed the necessity of continuing the treatment. Later Traube added to each hundred grams (℥iij) of sodium bicarbonate twenty grams (ʒv) of soluble saccharated iron oxid, and gave of this preparation three times daily a heaping dessertspoonful in a cup of cold previously boiled milk. Thus,

℞ Aquæ aurantii floris,
Acidi hydrochlorici, āā 20.0.—M.
S. Twenty-five drops in a glass of water three times a day.

Also,

℞ Ferri oxidi saccharat. solub., 20.0;
Sodii bicarbonatis, 100.0.—M.
S. A heaping coffeespoonful three times a day in a cup of milk.

The remedies are to be taken one after another as mentioned, and half an hour before meals. Traube hereupon details the history of eleven cases.

This method is certainly an improvement upon the method by which Bergeon secured the same results after inflation of the intestine.

We used this remedy also at the Good Samaritan Hospital in four cases of confirmed pulmonary tuberculosis, but no single symptom seemed to be favorably influenced.

**Sulphur, etc.**—Galen sent his patients to Vesuvius, both for sea-air and for sulphur. Niepce and Pilat ascribed a bacillicidal action to the hydrosulphuric acid of Bergeon. Claude Bernard demonstrated that hydrosulphuric acid injected into the rectum is eliminated by the lungs. In order to avoid the irritation of this acid, Bergeon injected hydrogen sulphid. The treatment is entirely without danger. It facilitates expectoration, diminishes cough, and favors sleep, but the bacilli persist in the expectoration, and fever, night-sweats, and laryngeal ulcers are not at all modified. The good effects are attributed to the sedative action of carbonic acid, as demonstrated by Brown-Séquard.

**Gold.**—Gold cyanid was recommended forty years ago by Chrétien, of Montpellier, in the treatment of scrofula, pulmonary tuberculosis, and amenorrhea. The remedy, however, fell into disfavor and oblivion, from which it was recently rescued by Oesterlein, who uses it in doses of from four to sixteen milligrams (gr. $\frac{1}{16}$—$\frac{1}{4}$), several times a day, as follows:

| | |
|---|---|
| Gold cyanid, | 0.2 (gr. iij); |
| Chocolate, | 48. (℥iss)—M. |

Make 26 pastilles.

S. Take from two to four per day.

Gold tricyanid has been employed by Oesterlein in the form of tablets, soluble in water and alcohol. Gold and sodium chlorid, in subcutaneous doses of from 0.002 to 0.02 gram (gr. $\frac{1}{32}$—$\frac{1}{3}$), also has been used. Koch in 1890 confirmed the fact that a solution of gold cyanid diluted down to 2 : 1,000,000 sufficed to check the growth of the bacillus tuberculosis in culture (Marfan).

Intrapulmonary injections have been made with corrosive sublimate, carbolic acid, thymol, mostly with indifferent or bad results. Fernet made a new attempt with camphorated naphthol. He made the injection once or twice a week, each time of 15 centigrams (gr. ii$\frac{1}{4}$) of the pure substance, in the first or second intercostal space.

Alexander, Bouchard, and Faure-Miller obtained good results from the subcutaneous injection of oil of camphor, 1 : 10 or 1 : 4. Two grams of the solution are injected every day for four or five days; then the treatment is interrupted for several days to avoid intolerance.

Thus every day sees born a new remedy; a few months pass, and the remedy falls into oblivion. "The therapy of pulmonary tuberculosis," said Daremberg, "has doubled its power since the authorities have readopted the doctrines of Hippocrates and Galen, who showed that *régime* and hygiene are the great curative agents." Bouchard did not hesitate to declare that the agents of hygiene ought to be of first importance in the treatment of pulmonary tuberculosis, and Peter says that, after works without number, modern medicine has arrived at the conclusion that the best medication of tuberculosis is hygiene. Daremberg maintains that when tuberculosis progresses slowly he does not hesitate to declare that it ought to be cured if the patient is properly directed and if his pecuniary circumstances permit him to adopt a comfortable existence (Marfan).

**Remedies that Improve Nutrition.**—Among these, *climate* holds the first place. In the absence of any absolute specific in the treatment of tuberculosis, all authorities agree that the best results are obtained by a stay in the proper climate. Two factors are essential, to wit, altitude and dryness. In this regard we are fortunate in having in America, in Colorado and adjoining States, the finest and best climate the earth affords; for with the necessary altitude and dryness may be obtained the comforts of life, which are absolutely essential in cases at all advanced. There is no real contraindication to climate. Financial conditions alone come into question; hence it is often said that the prognosis of tuberculosis depends upon the purse of the patient. The high, dry climate is especially indicated in cases of streptococcous infection, that is, in cases of septicemia. Every practitioner may recall cases in which, after failure of every other remedy, the selection of the proper climate has

resulted in a cure of the disease. Certain cases in which the prognosis has seemed to be desperate, in which even reproach has been cast upon the physician for having sent the patient away from home to die, put on a new phase in the high and dry altitude of Colorado. Wilson states that of forty physicians in Denver 30 per cent. were tuberculous when they went to Colorado, but they all attained vigorous health. Five who were in good health remained on account of tuberculous wives. He states further that one-fourth of the population migrated originally to Colorado "because of pulmonary disease in their families."

There is no real contraindication, and the idea that the existence of hemorrhage interferes is erroneous. Solly publishes notes on this point in the cases of sixty-two tuberculous patients at high altitudes and eighty-eight at lower altitudes. The time of cure of the sixty-two patients in the mountain climate was nearly 600 months, and of the eighty-eight nearly the same. Of the sixty-two patients, eleven had sixteen hemorrhages in the 600 months; but of the eighty-eight, thirty-six had sixty-two hemorrhages in the whole time of nearly 600 months; thus hemorrhages were four times as frequent low down as high up, and the cause of this difference resides in the less tendency to ulceration, septic conditions, and rapid decline on mountains, facts that find analogy in the circumstance that, as Brandis of Aix-la-Chapelle notes, hemorrhages were more frequent after operations, before the universal introduction of the antiseptic method, especially during the late war, than they have been since its introduction.

Solly also disposes of the idea that patients must remain away from home for the remainder of their lives. That persons cured of pulmonary tuberculosis upon the mountains can never live again in low climates is not the case. Of course an individual cured of tuberculosis will have to take care of himself for some years, and a return to the social and climatic conditions in which he became ill will always be dangerous; but this difficulty is usually much greater for those who have been cured in warm places than those who have been hardened by the mountains.

Altitude acts in various ways. In the first place it reduces the pressure of the air. At the border of the sea, with an elevation of 10.5 meters the barometer falls 1 millimeter. This relation holds good, however, only up to a height of about 70 meters. From this height up the barometer falls more and more slowly according to the elevation. The atmospheric pressure is also dependent upon the temperature, and here too there is no regular ratio, as similar variations of temperature produce great differences in the barometer at different elevations. An increase of temperature of 5° C. (9° F.), which causes no elevation of the barometer at the level of the sea, raises it in the highest habitable region (from 4000 to 5000 meters) as much as 5 millimeters. The explanation of this phenomenon is found in the heating of the ascending current of air. A part of the heat of the sun is absorbed by the air itself; hence the air expands, and of course in the direction of least pressure, upward. A reduction in the pressure of the atmosphere throws extra work upon the heart and lungs,

and thus by a process of unconscious but continuous gymnastics increases nutrition.

Along with the reduction of pressure is a corresponding purity of the atmosphere. According to the painstaking investigations of Miquel, the air of Paris contains to every 10 cubic meters 55,000 bacteria. These bacteria decrease steadily with the altitude until, at a height of 13,122 feet, they disappear entirely. If the air of high altitudes be made impure by the presence of tuberculous patients, especially in confined apartments, the mere reduction of pressure gives no exemption from tuberculosis.

Geddings quotes from Sée the best proof that altitude alone exercises only a questionable influence, in that among the inhabitants of elevated regions when crowded together in confined localities, as is the case in workshops like those at Joux and Chaux de Fond, in the Swiss Jura, at an elevation of 1100 meters (3609 feet), one finds as many tuberculous patients as in the city of Berlin.

Tubercle-bacilli may live dry six months on cloth, but they thrive and multiply only with moisture. Most resorts for tuberculous patients have a dry atmosphere. Thus Colorado and New Mexico show a mean annual relative humidity of from 49 to 61 per cent.; Aiken, S. C., 58 per cent.; the Riviera from 64 to 68 per cent.

Denison publishes a series of maps, with a paper on the "Preferable Climate of Phthisis," showing in striking colors the humidity of various portions of the United States.

Jaccoud divides climate into two classes:

(1) The climate of altitude, with a low barometric pressure, tonic and stimulating, found at elevations of from 1500 to 1900 meters. But climates in altitudes less high than this, from 1000 down to 500 meters in the north, may be embraced in the same class, for, if they do not have the same diminution of pressure, dryness with purity, they possess other meteorologic conditions which have a tonic influence like the climate of mountains. For instance, there is, in Europe, the climate of Falkenstein, 500 meters; Goerbersdorf, in Silesia, 557 meters; Austei, in Styria, 700 meters; Gaudal, in Norway, 805 meters; Davos, in Switzerland, 1556 meters; St. Moritz, in Switzerland, from 1743 to 1855 meters.

(2) Climates of the plains, with a medium or less than medium barometric pressure, have a sedative and calmative influence. They comprise all the stations, mountainous or not, whose altitude is below 400 meters. Jaccoud places in the first rank among these places Madeira and Algeria; next, Egypt, Meran in the Tyrol, Montreux and Lugano in Switzerland, Pisa in Italy, stations of the Riviera, etc. Cannes is more exciting than Mentone; Mentone more exciting than San Remo; and this in turn more so than Spezia, or the borders of the Mediterranean in Greece, Spain, and Portugal, or the Canary Islands. These stations are more favorable because the temperature is subject to so little variation. They are especially adapted to febrile cases in the period of so-called softening, to cases affected with acute bronchitis, congestion, pneumonia, especially with emphysema and laryngeal tuberculosis, tuberculosis of

the intestine, to those in whom the lesions are extensive; in fine, to the cases in the confirmed period of the disease. It matters little what station is selected on the seaboard. Laennec was convinced of the beneficent action of sea-air. Sea-voyages, as recommended by Aretæus and by Pliny, meet with renewed recommendation by modern physicians for the same reasons. When patients established in one region find themselves not benefited, they must change. Certain individuals may adopt a fixed residence; others may seek one station in winter, another in summer. Here may be recommended La Bourboule, at Mont Doré, and the feeble sulphurous waters of the Pyrenees, especially at Eaux-Bonnes.

The conditions of the high and dry climate are best met in our country on the elevated plateaus of Colorado and New Mexico, especially at Glenwood Springs, Colorado Springs, Manitou Springs, Santa Fé, etc. The conditions of moderate elevation with pure atmosphere are found in Asheville, N. C., Aiken, S. C., the Adirondack Mountains; while the soft, soothing influences of a balmy atmosphere are provided in Lower California, and especially in the Bermudas and the Bahamas, as at Nassau. Florida is too moist and the air is too still for tuberculous patients.

As already stated, when a patient finds that he is not benefited after a stay of one month, he should change his climate. The rich man is able to make this change. For the poor there are being provided sanatoria. Such institutions exist already in this country in the Adirondack Mountains and at Colorado Springs.

Every practitioner of experience may corroborate the statements of Penzoldt when he says that the benefit of climate is often exemplified in the case of a young woman who will come to the office of the physician pale, with drooping shoulders, and anxious and melancholy mien. The examination reveals tuberculosis at the apex. The patient is recommended to go to a proper climate (he says to Falkenstein). The advice is received with dejection, but is eventually followed. In the course of nine months there returns to the office a lady of blooming appearance, in elegant attire, who greets the physician with the words, "You don't know me any more." And in fact it is difficult sometimes to recognize the patient, the change has been so great. Sometimes such a patient will say that she knew the lungs were affected, but had no idea they could recover until she learned how to live as the patients are taught in these institutions.

The cold climate is more beneficial for strong individuals. Advanced cases and feeble patients may be sent to a warmer climate. Sunlight has a fine effect; fogs and clouds are injurious. After all, the main benefit of climate is secured where the atmosphere is the most pure, so that the patient is protected against infection, especially by the micro-organisms of pus. Dryness is a main feature in such a climate. While various single features may predominate in different parts of the earth, especially in Switzerland, there is no place that can compete with Colorado for the combination of all the most desirable factors in the treatment of tuberculosis. Every altitude this side of

Colorado falls short, and the sending of patients to other places, aside from individual considerations (as the presence of relatives or friends, the character of a habitation, or the services of some particular physician, etc.), is only temporizing with the disease. While any patient affected with tuberculosis in any stage of the disease may receive benefit in Colorado, it is by no means necessary to send patients in the first stages. It is only when secondary or mixed infection occurs, or when such infection is severe, as indicated by the hectic fever, etc., that the necessity becomes absolute. It is astonishing what improvement takes place sometimes in desperate cases. At the same time it must be admitted that medicine sometimes suffers reproach from too long delay.

I treat all of my cases with tuberculin in small quantities at long intervals, from $\frac{1}{100}$ to $\frac{1}{20}$ of 1 per cent. once or twice a week, using as adjuvants the hypophosphites, arsenic, cod-liver oil, etc., etc. The great majority of cases may recover in this way in the course of time, usually a long time; that is, about as long as should be properly devoted to the treatment of syphilis. Failing to produce an effect in the course of, say, three months, the patient is advised to seek a change of climate.

Sydenham long ago emphasized the value of horseback-exercise as, to use his own quaint term, "bearing the bell" over every other means of therapy; and, though few would accord it a place as a "specific as valuable as cinchona-bark for ague," no one will deny its supreme value in certain cases. The open-air treatment has been recommended recently by Beer, Dettweiler, and others, especially in sanatoria, as by Brehmer at Goerbersdorf, Silesia; by Dettweiler, at Falkenstein; by Turban at Davos, Upper Engadine; by Sabourin, at Vernet, Oriental Pyrenees; by Lauth at Lausanne, Switzerland; by Trudeau, at Saranac Lake, New York.

Patients in these places are exposed in rooms to the sun from mid-day to evening. The treatment is thus described by Marfan: Patients observe rest in reclining chairs, and are provided with books, games, etc. The following is the *régime* of the day: At eight o'clock in the morning a domestic enters the room and closes the windows, which have remained open all night. He lights a fire and serves the first breakfast. After this the patient is sent to the "cure." He is put in a long chair, in which he remains with his body and legs warmly covered, his feet on a bottle of hot water, until eleven o'clock. At eleven there is dinner at *table d'hôte*, after which the patient enjoys a promenade, whose duration is varied according to the prescription of the physician. The promenade is made on the terrace of the sanatorium or in the winter-garden connected with it. After this promenade the patient returns to the "cure"—that is, he resumes his place in the reclining-chair and passes the whole of the afternoon in a state of

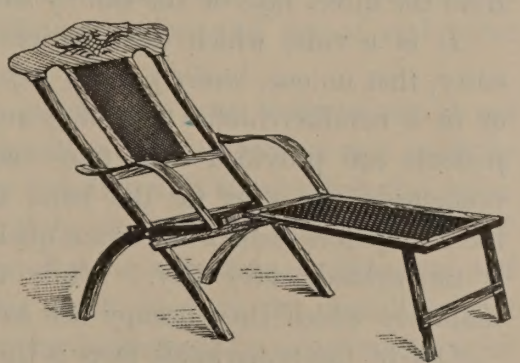

FIG. 18.—Reclining-chair.

repose almost absolute; but quiet games, cards, dominoes, conversation, and reading are not forbidden. Certain patients indulge in a profound sleep, which, strange to say, does not in any way interfere with the sleep of the night. They who thus sleep become veritable hibernizers, and thus economize their nutrition and seem to experience a more rapid cure. Before dinner the

FIG. 19.—Basket-cove, etc.

stronger are allowed to take a short promenade. At six, dinner is served, *table d'hôte;* after dinner another promenade is made, shorter than that of the afternoon, followed by a return to the "cure" until ten o'clock in the evening. At this time the kiosks and galleries are lighted with gas. At ten the patient goes to bed and sleeps in a flannel gown, with the windows more or less open all night long.

Furred shoes and galoshes are worn always during winter, so that no one at the sanatorium suffers in the least from cold. Patients at rest are protected from the direct rays of the sun by shades, and in walking by parasols.

It is a rule, which each patient engages to observe immediately upon entry, that no one, *under pain of expulsion*, shall ever expectorate on the floor or in a handkerchief. Cuspidors are scattered throughout all the rooms, and patients are provided with two—one for the pocket, to be used during the promenade, the other for the hand during the "cure," day and night. All these cuspidors contain a certain quantity of liquid and some sawdust, which is incinerated every day. While the patients are on the promenade the chambers which they occupy are submitted to a complete disinfection.

One of the remarkable facts is the rapid acclimatization of patients to cold, whether feverish or not. In the course of a few days the patient endures exposure to the free air from nine in the morning until ten in the evening. As soon as tolerance is established there is a notable diminution of cough.

Patients are instructed never to cough unnecessarily, but only when the cough may be efficacious by being followed by expectoration. It is surprising to learn how little coughing is done at the sanatorium. Fever disappears at once, and night-sweats cease; the patient begins to gain in weight, and the *morale* improves. Bacilli diminish in the sputum and after a while totally disappear. Creosote is given in large doses. Success depends altogether on the rigidity of the discipline. The patient must obey blindly. He must pay no attention whatever to the counsel of his *entourage*, and absolutely refuse to accept remedies which are so numerously offered by obliging friends. A rich patient need not shut himself up in a sanatorium, but may choose a climate.

The rest-cure is well carried out in Falkenstein. Patients rest in a hammock or in portable chairs which are properly cushioned, and the body is protected from cold by blankets and furs and by the frequent administration of hot milk. The patient lies in such repose from seven to ten hours a day, even during the rigors of winter, which, according to Dettweiler and Meisner, do no harm. The number and the duration of the intercurrent exacerbations of the disease-process, which are naturally much more frequent in winter, become decidedly lessened in these institutions.

In this connection may be mentioned also the use of inhalations of oxygen, which are of benefit in cases of excessive purulent secretion. Mathieu and Nabain demonstrated that pus absorbs oxygen and transforms it into carbonic acid. This vitiation of the pulmonic atmosphere by pus is rapidly corrected by inhalation of oxygen, and this method of medication may at least increase the duration of life.

*Alimentation.*—Diseases usually receive their names from the most prominent symptom. Emaciation is the most obtrusive sign of tuberculosis; hence the term phthisis, from $\varphi\theta\acute{\iota}\omega$, to waste, and the Latin equivalent, *consumptio*, consumption. From time immemorial endeavor has been made to counteract the loss of weight by alimentation.

Debove made some reports of remarkable successes with forced feeding, or feeding in excess, in what he called *suralimentation* with different kinds of food; but this method, sooner or later, brings about digestive disturbance which invalidates the results. Weir Mitchell's methods of "massage" in combination with increased diet form a more scientific suggestion, and are of real value in certain cases.

Whether any kind of food may act injuriously upon tuberculosis is not accurately determined, but a curious observation in this direction was made by Buchner, who found that in guinea-pigs infected with tuberculosis the injection of an alkaline albuminoid derived from the thymus gland of the calf brought about a remarkable softening—analogous, according to Schmaus and Uschinski, to genuine suppuration. This result suggests the possibility that the effects of certain forms of food may be determined by experiments upon animals.

All that can be said at the present time is that animal food should predominate, for it is known that carnivorous animals are more resistant to infec-

tion with tuberculosis. At the same time, with this predominance of animal food, there should be no exclusion of vegetable aliment. Of all foods milk is the best. It is generally preferred cold, sometimes even sour. It may be swallowed in larger quantity when bread or Zwieback is taken with it, or, when there is distaste, it may be made more palatable by the addition of a little coffee, tea, cocoa, cognac, rum, or whisky. The alcohol should be added slowly and be well stirred during the process, to prevent coagulation of the casein. The milk should in all cases be first thoroughly boiled. Lime-water, from one-fourth to one-third, may be added when diarrhea exists; Seltzer water, from one-third to one-half, may be given to prevent constipation. The form of the milk may vary; sweet milk, buttermilk, sour milk, additions of cream, may afford desirable changes. Or the milk may be replaced by malted milk, by koumiss or kefyr. Milk should be taken in quantities of from one to two pints per day. Kefyr is usually given in the dose of a wineglassful four times a day and gradually increased up to a pint or more.

The food of the highest force is alcohol. It needs no digestion. It passes the most quickly of all foods into the circulation, is oxidized at once in the blood and tissues, where it is completely resolved into water and carbonic acid, whereby are liberated force and heat. The combustion or consumption of 15 grains (1.) of alcohol furnishes heat enough to raise in temperature $1\frac{1}{2}$ gallons of water 1.8° F. (1° C.). So much is called one caloric, or heat-equivalent, of which the body of a healthy man furnishes daily 2000. In other words, power sufficient to raise the body to a height of six miles is daily evolved from the food taken by a healthy man. So, a bottle of good Rhine wine, or its equivalent in whisky or brandy, will furnish all the heat the body can produce on a mixed diet. Four tablespoonfuls of cod-liver oil, which is about all that a healthy stomach can well dispose of in a day, will develop but 455 equivalents of heat, only a little more than half that developed by a bottle of good wine. The superiority of alcohol as a food over every other kind is therefore a matter of mathematic demonstration. No account is taken in this statement of the fact that alcohol is often the only food that can be absorbed from the stomach by tuberculous patients. It need not be said that account is taken of alcohol used solely and exclusively as a food, and not in the excess which of itself produces disease.

Alcohol, says Ziemssen in a recent contribution, has become in the last decades more and more engrafted upon the treatment of tuberculosis, and it deserves, indeed, a prominent place in the therapy of the disease. It acts chiefly on the nervous system, producing an agreeable feeling of comfort, warmth, and strength. It invigorates the muscles, lessens night-sweats, induces sleep, and, through refreshment of the central nervous system, improves all the functions. Good, strong red wines, with occasional doses of fine old cognac, are the forms preferred. Sugar, cinnamon, and spices, added to hot potations, are, according to Ziemssen, extremely agreeable to the mucous membranes of tuberculous patients, and are often effective agents in preventing and checking diarrhea. Brehmer, too, finds brandy in proper dose the most effective agent in preventing night-sweats and securing sleep.

Dettweiler found the alcohol-cure to be of great value in certain cases. Alcohol is especially indicated in feeble patients, who easily suffer chills, and whose temperature falls below the normal. Such patients may take a teaspoonful of cognac every hour or two. The strong Rhine and Hungarian wines may be preferred. In the United States whisky is used by preference on account of its greater purity. In all cases care must be taken to avoid the habit. Alcohol is contraindicated in case of hemoptysis and gastritis.

A curious illustration of the value of food was furnished in the statistics of Kless regarding the frequency of tuberculosis in the penal institutions of Würtemberg. In these institutions the annual mortality from tuberculosis in the years from 1850 to 1859, amounted to 24 per cent. During the year 1859 the diet-list was greatly amplified, along with other hygienic improvements, and the mortality from tuberculosis declined to 8 per cent.

It goes without saying that much will depend upon the method of preparing the food. Patients affected with tuberculosis should take food more frequently, and may learn to wash down solid and dry food with libations of wine or beer.

The additional resistance of the body to the invasion of the tubercle-bacillus imparted by food is best exemplified in the mortality-statistics before and after the general introduction of cod-liver oil—the food of the highest force-value of all foods, with one exception.

Thus, the elder Williams, in speaking of the first ten years of his practice, from 1830 to 1840, remarks that the beneficial effects of treatment were limited to incipient cases, and especially to those that were able, at an early stage, to take long voyages—as to Australia or India. "My general recollection of the histories of the developed disease," he continues, "is that of distressing tragedies, in which no means used seemed to have any power to arrest the malady; and life was rarely prolonged beyond the limit of two years, assigned by Laennec and Louis as the average duration of the life of a consumptive."

Improvement began in the next decade, from 1840 to 1850, with the administration of a more liberal diet, the use of iodin, and, more especially, of a mineral acid—generally nitric acid; but it was only in the latter half of this period, when chemistry began to produce cod-liver oil of sufficient purity and freshness to be fit for the human stomach, that decided change for the better was observed; "and I have no hesitation," to use the language of the conscientious observer quoted, "in stating my conviction that this agent has done more for the consumptive than all the others put together."

The most conclusive evidence in this direction was furnished by the younger Williams, who succeeded his father in charge of the Brompton Hospital, in observations based on 250 cases wintering at foreign health-resorts. Of these patients, forty took oil irregularly or not at all, with a duration of life of four years and eight and one-half months; the remainder furnishing a duration of life of eight years for those that had died, and nearly nine years for those still living at the time of the observation.

The value of the oil, as well as that of other influences which arrested and cured pulmonary tuberculosis long before the discovery of the tubercle-bacillus and its relation to the disease, is attributed solely to the "improving of the bioplasm and constitutional resistance, thereby enabling the various cells to become the destroyers and not the victims of the bacillus."[1]

Since 1790, when Perceval first proposed it, cod-liver oil has been used constantly. It has a complex constitution, containing both olein and margarin, substances which act as fatty nutriment, and besides, phosphoretted substances and alkaloids. These last bodies excite the activity of the trophic nervous system and increase the appetite. Amber-colored oils are the best; either white or black oil should be rejected. The minimum dose should be four dessertspoonfuls a day, the maximum twelve. The oil has its best effect in winter. Oil fattens, but fattening is not curing. There are patients who die of pulmonary tuberculosis while the weight is increasing. Cod-liver oil is badly tolerated when there is dyspepsia or fever. Under these conditions Jaccoud replaces it with glycerin, which, on account of its alcoholic character is well digested when there is fever. Glycerin, as a polyatomic alcohol, is a sparer of tissue-waste. Jaccoud gives in two or three doses 40 grams (f℥x) a day, with a drop of the essence of peppermint, and 10 grams (f℥iiss) of cognac or rum. Palatable preparations, especially for children or dyspeptics, are made by emulsions with yolk of egg.

The following dietary is taken from the work of Marfan: Tuberculous patients should be nourished especially with meats, egg, fat, milk, and oils, with the green vegetables. As for drink, tea lightly alcoholized, or beer, is better than wine. To make up for the loss of nutrition the patient must eat much meat—fish, flesh, and fowl. Raw meat is sometimes useful, scraped with a knife, rubbed in a mortar, and passed through a sieve. It thus reaches the stomach in a state of fine division, and is easily peptonized. Such meat may be prescribed in the quantity of from 80 to 200 grams (2½–7 oz.), and used in the form of a bolus and rolled with powdered sugar, or in bouillon. Of course raw meat may sometimes convey tape-worm, but this is not dangerous. Bouillon may be taken in moderate quantity, as it excites the appetite, but it has the disadvantage that it contains the salts of potassium, which are injurious to the hydration of the albuminoids. Eggs form a basis of alimentation: the white of the egg is very assimilable; the yellow contains fat which is very useful. Animal fats are advantageous in the form of brains, yellow of egg, fat of ham, etc. The fats prevent or limit the disassimilation of the phosphates, according to Bischoff, and in this way are to be interpreted, in part at least, the good effects of cod-liver oil. Milk is, as stated, a complete aliment. The patient may take from a pint to a quart in twenty-four hours. If the milk of the cow or of the goat is badly tolerated, one may try the milk of the ass. Cheese is a good aliment. Patients who dislike milk may try koumiss or kefyr. Green vegetables are but little useful, because they contain little nutritious matter, with a large volume, and are rich in salts of potassium.

[1] Williams: *Pulmonary Consumption*, 1887, p. 336.

Bread should be used in less quantity than meats, because much less nutritious. The same remark applies to beans, peas, potatoes, green farinas.

Daremberg gives the following daily diet:

| | |
|---|---|
| Raw flesh | 600 grams (21 oz.); |
| Bread | 350 grams (12 oz.); |
| Two eggs, butter, and fat | 80 grams (3 oz.); |
| Potatoes | 100 grams (3½ oz.); |
| Rice, macaroni, peas, beans | 300 grams (10½ oz.); |
| Beer | 1 liter (1 quart); |
| Milk | ½ liter (1 pint); |
| Cognac | 20 grams (5 drams). |

To this is to be added a little cheese and fruit. This quantity may be taken in three, four, or five divisions. In general the patient should take four repasts: In the morning a cup of milk or an egg; at mid-day meat, vegetables, butter, cheese, dessert; at four o'clock a cup of milk and an egg, at seven o'clock the same repast as at mid-day. Some patients may take a cup of milk on retiring. No rule should be immutable.

Weber and Dettweiler give the following diet-list for well-to-do people:

7 A. M. or earlier, in bed: A cup of milk with a teaspoonful or dessert-spoonful of cognac, or a cup of tea or cocoa, with a small piece of bread and butter.

9 or 9.30 A. M., after dressing: Breakfast—milk, with tea, coffee, or cocoa, bread and butter, ham, fish, or smoked meat.

11 A. M.: A large glass of milk or koumiss or a cup of beef-tea or other meat-soup, a piece of bread and butter, and a glass of wine.

1 or 1.30 P. M.: A substantial meal of meat, game, fowl, or fish, with fresh vegetables and some light pudding or cooked fruit, and with it a glass of wine.

4 P. M.: A glass of milk or koumiss, a cup of tea or coffee with an excess of milk, bread and butter or some light biscuit.

7 P. M.: A substantial meal like that at 1 P. M.

9.30 or 10 P. M., before going to bed: A cup of milk, or bread and milk, or milk with some farinaceous addition.

*Arsenic, the Hypophosphites, etc.*—Arsenic has been considered a specific. Its favorable action is on nutrition. It spares waste (Sée). It stimulates assimilation (Peter). Perhaps it acts upon the trophic nervous system (Daremberg). It often happens that the weight increases under its use. It ought not to be given in cases of extreme intestinal trouble or hemoptysis. Marfan gives arsenic three days a week, that is, fifteen days of every month. It should not be given in too large doses. Marfan mentions the case of two confrères who took arsenic in large doses and who died under an enormous *embonpoint.* They were fat, puffy, and pale. The arsenic did not prevent death. Arsenic may, however, be given in the form of mineral waters, as in

the water of La Bourboule, a wineglassful every day. The water of Mont Doré is also arsenical, but the mineralization is too feeble to attribute to it any real efficacy. Tuberculous patients are often sent to Mont Doré. They get benefit from inhalations of hot water, which facilitate cough and expectoration; from the baths, which produce cutaneous excitation; and from the altitude, 1050 meters. Arsenic in mineral waters is most given in the United States in the Roncegno and Levico waters. The Asiatic pill, which contains also piperin and a minute quantity of opium, is a favorite prescription. Buchner has recently revived the use of arsenic.

The hypophosphites are regarded by many English observers as veritable specifics. The good is probably effected by the substitution of the enormous loss of the phosphites that occurs in the course of pulmonary tuberculosis. The same end may be reached by the use of calcium phosphate, the milk of the cow, which animal absorbs every day 80 grams (3 oz.) of calcium phosphate, or of a goat, which absorbs daily 30 grams (1 oz.). Marfan prescribes cod-liver oil, phosphorus, and creosote, as follows:

| | |
|---|---|
| Cod-liver oil, | 300 grams (10½ oz.); |
| Creosote, | 15 grams (½ oz.); |
| Phosphorus, 1 : 1000, | 30 grams (1 oz.).—M. |

Give a dessertspoonful after each meal.

This combination is efficacious when well tolerated, but it often happens that it is badly borne. Patients should take plenty of common salt, to make good the great losses by the sputum and the urine. The hypophosphites, in the form of the compound sirup, are prepared with an extra quantity of *strychnin*, which is itself the best support and stimulant of the heart through the nervous system.

The subcutaneous injection of *spermin*, according to Brown-Séquard, renders service by increasing the tone of the nervous system. It stimulates the appetite, suppresses sweats, and thus increases the strength, but does not really modify the disease. Its real value lies in the power of "suggestion."

*Care of the Skin.*—Particular attention should be devoted to the care of the skin, to excite the trophic action of the nervous system. It should be remembered that the skin, developed with the nervous system in the embryo from the epiblast, belongs to this system. Massage should be practised daily, morning and evening, especially at night in cases of night-sweats, with alcohol or turpentine, or friction may be made with flannel. Light frictions at night with vinegar or with salts are useful for patients with slight evening fever or with general atony and chilly sensations. The patient kneels in the center of a zinc tub and the attendant places on the back of his neck two large spongefuls of water, which thus passes over his body. The water should be at first 22° C. (71.6° F.) and progressively reduced to 12° C. (53.6° F.). Hereupon the patient is rubbed vigorously, rolled in a blanket, and put to bed for from fifteen to twenty minutes. Cold douches of from four to ten seconds in dura-

tion are recommended by Brehmer and by Sokolowski. They are advised by Jaccoud only in the beginning of pulmonary tuberculosis in the absence of fever. The cold douche has the advantage of hardening the patient against cold, increasing the activity of the skin, making him breathe more deeply, and stimulating all the organs of the body, but it should be used with great prudence (Marfan).

**Surgical Treatment.**—Surgical intervention began with parenchymatous injections, which were first practised by Wilhelm Koch, in 1873, and were followed up by Fraenkel and by Mosler, who was amongst the first to attempt the local treatment of cavities by aspiration of their contents and injection of antiseptics. This idea was further pursued by Pepper and Fenger, of the United States, and by the opening and drainage of cavities in the lungs. Resection of the lung was first practised by Gluck, on dogs, in 1881, and by Schmidt, who showed a number of animals which had survived the operation. Several surgeons, Block, Kaenlen, Ruggi, and Tuffier, resected tuberculous lungs in man. The operation proved very dangerous; according to the statistics of Park, in 1887, half the patients died. Tuberculosis of the lungs is never wholly circumscribed at the apices; there is infection also of the bronchial glands and often other depots of the disease; hence any surgical intervention in the case of the lungs can be attended with no real curative results.

**Miscellaneous Treatment.**—Other remedies recently recommended are inhalations of hydrocyanic acid, by Koritschow; of nitrogen, by Bétancès; of osmic acid, by Valenzuella; of picric acid, by Hue; of helenin, by Korab; of gaseous chlorin, by Gibbes and Shurly; of chloroform, by Desprès; of anilin oil, by Kremiansky; intrapulmonary injections of pyoktanin and methylene-blue, by Petteruti, Mirto, and Althen; subcutaneous injections of methyl-violet, by Boinet; transfusion of blood, by Carmalt Jones; electrization of the cervical sympathetic, by Liebermann; faradization of the thorax, by Soupiuski; electrolysis (laryngeal) by Gruenwald. None of these remedies is worth more than mere mention. They serve only to illustrate the power of suggestion, not only in the patient but in the mind of the physician himself.

**Treatment of Symptoms.**—*Fever.*—In tuberculosis the fever is a source of great difficulty. To combat the fever would be to control the situation. By this statement, however, it is not meant that the reduction of fever would cure the disease. By no means. The fever is an effect of the cause of the disease, and the cure of the disease can result only when the cause is removed, or the conditions of its persistence in the body are changed. The fever is a common index of the gravity of the situation. It is of more importance in prognosis than any other single factor, including here even the extent of the disease. The extent of the disease and the degree of fever commonly correspond, but to this rule there are many exceptions. Fever is an expression of absorption rather than infiltration, and a patient with slight local lesions may have high fever, while extensive lesions may be attended with little or no fever. Advancing disease is marked by increase of fever, and continuous

fever indicates an unfavorable prognosis. Nevertheless it is true that fever reduces the strength less in pulmonary tuberculosis than in any other disease.

Billet studied especially the tuberculous infectious fever described in France by Landouzy, which occurs in cases of miliary tuberculosis that run the course of an acute infectious disease much like typhoid fever. The French maintain that such cases recover more frequently than is believed, if not permanently, at least temporarily. Billet believes that many of the cases of typhoid fever regarded as peculiar are really cases of tuberculosis. The points of diagnosis are irregularity of the fever, more frequent, non-dicrotic pulse, rarity of the brain-symptoms, absence of meteorism, thin stools, roseola, and early occurrence of severe bronchitis. With a favorable termination, however, a diagnosis is often dubious in spite of these distinctions.

The temperature of pulmonary tuberculosis may be lowered in two ways: 1. By immediate address to the fever as an effect, that is, by the antipyretics. 2. By attacking the cause. The causal treatment of fever is the correct one. This treatment is, however, as yet a matter of the future, except in so far as the conditions upon which the growth of the cause depends may be changed.

Antipyretics have at best only a temporary effect. They are of but little value in the treatment of the fever of tuberculosis. The fever of tuberculosis is one whose course is too long to be controlled by antipyretics. It is only in the most extreme cases that the use of the stronger antipyretics is justifiable, and then only for a short time—that is, antipyretics may be used only to control excesses of temperature. The most potent remedies are antipyrin, antifebrin, phenacetin, and quinin. They are all administered in doses of from 5 to 10 grains (0.32–0.65) at intervals of from two to four hours, before and during the period of fever. The use of quinin has been practically abandoned on account of the unpleasantness of its cerebral effects. Antipyrin and antifebrin are employed only in the most extreme cases, for a short time, and their use must then be discontinued on account of the depressing effect upon the heart. Phenacetin is safer, because the depression of the heart is less. Nevertheless its use is sometimes followed by collapse, and even cyanosis. The salicylates are safer remedies, in patients with slight fever especially. Patients that suffer with rheumatic and neuralgic pains are much benefited by the judicious use of sodium salicylate, or more particularly of salol, in doses of from five to seven grains (0.32–0.45) from every two to four hours. Sodium salicylate acts more quickly, but it sometimes causes anorexia and dyspepsia. Salol is safer in that it does not affect the stomach; but as it liberates carbonic acid in the intestine it should not be given in any case of stasis of the kidney. Lactophenin and apolysin are, in the same dosage, efficacious and free from danger.

Creosote and its preparations applied by inunction reduce the temperature in certain cases, but with no distinct effect upon the disease. The best antipyretic in tuberculosis is alcohol, which may be given in any form that the patient prefers. A good cocktail will answer the purpose. In the experience of the various sanatoria, it is found that quiet and rest, with permanent exposure to sunshine and fresh air, are the best of all means for the control

of fever. As already remarked, the temperature begins to fall at the end of the first weeks of treatment as the disease gradually comes under control. Cases in which the fever persists in spite of this treatment have, as stated, a bad outlook. The disease then soon passes "beyond the resources of art."

Brehmer's method is the best. Brehmer gives alcohol in the form of Hungarian wine, from one to three wineglassfuls per day, never more than one bottle. Given in moderate doses alcohol reduces the temperature and diminishes the metabolism of the albuminoids, but in large doses it does harm by increasing metabolism. Brehmer found in one patient, who drank secretly two bottles, a marked increase of temperature. The wine should be given as soon as the temperature begins to rise, and in quantity corresponding to the height of the rise. Chills offer difficulty. Brehmer advises the patient to take at least a glass of wine an hour before the time of occurrence of the chill of the previous day; by this means he secured in most cases a postponement of the chill. Finally it remains away and is replaced by a mere feeling of coldness, blue nails, cold hands, until these too disappear and leave only the elevation of temperature. The course is so like that of intermittent fever that these patients are often treated for this, and are injured by large doses of quinin. The patient usually takes his wine too late. He should take it all at once, and, as stated, an hour before the occurrence of the chill of the previous day—one glass, and at the latest a second glass half an hour afterwards. The patient should stay in bed longer, and before he gets up in the morning should have a draft of warm grog or punch. He should not use an ice-bag until the chill has entirely subsided. The bag should be applied for an hour over the region of the heart and should be left in place until the temperature has fallen. Patients often go to sleep with the ice-bag on the chest; therefore it should be made of some vegetable membrane, which adapts itself more readily to the chest and more securely prevents the escape of water (Marfan).

Petruschky, at the instigation of Koch, made a number of experiments with the various ethereal oils used in the treatment of putrid bronchitis, in the hope of influencing the complicating micro-organisms of tuberculosis, and thus preparing the patient after the fever for treatment with tuberculin.

The remedies used were oil of turpentine, oil of peppermint, oil of pine, oil of eucalyptus, and also camphor, especially camphor dissolved in acetic ether 1 : 10, by continuous inhalation. Of 34 cases thus treated, 7 died; 6 were released, at their own wish, with continuance of the fever; in 21 cases fever was checked and the tuberculin-treatment was instituted with good effect.

During the existence of fever, especially during recent exacerbations, the patient should observe absolute rest. This is best had in the process of the rest-cure as it is adopted in institutions for the treatment of tuberculosis, or as it may be observed at home, especially in the open air in reclining-chairs or hammocks. When the season permits, the patient may spend the greater part of the day in the open air under trees, or in protection against wind in a tent which may be opened and closed in the right direction. Sometimes the bed may be adjusted upon a porch while the body is kept warm with soft, thick

covers and by the use of hot-water bottles. Reclining-chairs may be so arranged with adjustable apparatus as to enable the patient to take his meals and to read and write with ease and comfort. The open-air treatment with libations of alcohol, in conjunction with rest, is the best treatment of the fever of tuberculosis.

The patient should never be allowed to take his own temperature.

*Cough.*—Cough is the effort of Nature to cure the disease, whereby the patient literally spits it out; therefore some cough is salutary. Cough is of two kinds—that caused by irritation and inflammation of the bronchial mucous membrane, and that caused by the presence of disease-products. Both kinds of cough are useful, in that they finally effect the discharge of the products of the disease; but that which depends upon simple irritation is injurious when excessive. It harasses the patient, and exhausts the strength; when severely prolonged it evacuates the stomach, so that the patient loses his aliment; it also breaks or prevents sleep. In such a case the patient awakens or arises in the morning unrefreshed, worn and haggard. All useless cough must be suppressed as much as possible by the effort of the patient, who must be taught to conserve his strength for efforts that will secure expectoration. The sovereign remedy in allaying irritation and excitement of any kind is opium. All the discoveries of modern times, all the remedies in materia medica sink into insignificance compared with opium in this regard. It quiets cough, it soothes excitement, it produces sleep. But opium is a two-edged sword; it ruins the appetite, it dries up the secretions, and in quieting cough too much it prevents Nature from discharging the products of the disease, and thus favors its spread. Opium is usually resorted to only in extreme cases with reference to euthanasia, but it may be given with judgment and discretion occasionally, especially at night, with great benefit, and it may be used with much less reluctance in cases in which address is made to the cause of the disease. Of the preparations of opium the simplest and least injurious is codein. The following are good formulæ:

℞ Codeinæ, gr. ij–iv (0.13–0.26);
Syrupi phosphat. compositi, ɪ℥j (30.);
Aquæ lauro-cerasi, f℥ss (15.);
Aquæ, ɪ℥ss (15.).—M.
S. A teaspoonful for cough.

℞ Morphinæ sulphatis, gr. j (0.065);
Aquæ lauro-cerasi,
Syrupi, āā f℥ss (15.);
Aquæ, f℥j (30.).—M.
S. A teaspoonful for cough.

In mild cases half a teaspoonful of cherry-laurel water occasionally may suffice to control the cough, or from a teaspoonful to a tablespoonful of chloroform-water may have the same effect. Chloral acts kindly in relieving the cough of pulmonary tuberculosis. I often prescribe chloral as follows:

℞ Chloral hydratis, gr. xl (2.59);
Aquæ menthæ piperitæ, f℥ij (60.).—M.
S. A teaspoonful for cough.

The harassing cough that prevents sleep at night may be relieved by from gr. 5 to gr. 15 (0.32–0.97) of trional taken in a cup of hot tea or milk at bed-time. A wineglassful of good sherry wine, a tablespoonful of good whisky, or a teaspoonful or a dessertspoonful of brandy sometimes acts admirably. Alcohol acts best in relieving cough when strongest; hence it should be diluted only so much as will prevent irritation of the throat. When cough depends upon the accumulation of tough, glutinous mucus or pus, it may be relievable only by the fluidification of these products. Inhalation of steam from atomizers here comes into play, and the fluids used may be medicated with soda, creosote, turpentine, and so forth. Menthol sprayed into the throat often quickly relieves the intense irritation of laryngeal tuberculosis. The following formulæ may be employed:

℞ Menthol, gr. ij (0.13);
Spiritus rectificatus,
Aquæ, *āā* f℥ij (60.).—M.
S. To be used with an atomizer.

℞ Menthol, gr. j (0.065);
Camphor, gr. ij (0.13);
Liquid vaselin, f℥j (30.).—M.
S. To be used as a throat-spray.

On account of the inflammability of menthol, the remedy should be sprayed into the throat from a hand-ball atomizer.

The adoption of a simple suggestion made by Landouzy is sometimes attended with good results. This is the subcutaneous injection of sterilized pure water in the subclavicular region over the site of the râles heard. This plan, which Marfan distinguishes as absolutely inoffensive, often quiets the cough quickly, safely, and surely.

It should be remembered that cough makes cough. As Penzoldt remarks, it is a good deal like itching, the relief of which by scratching excites the itching more, so that slight itching may be made severe by continued irritation. Sometimes cough may be restrained by holding the breath a little longer, or, when due to the irritation of cold air, by breathing through a handkerchief held to the nose. A light cough that is dependent on irritation of the throat may be relieved by preparations of candy, or by pastilles of licorice or some gelatinous substance, such as gum arabic or Iceland moss. The Ems pastille is a favorite remedy. Sometimes a single swallow of strong whisky will allay irritation of the throat.

*Expectoration.*—Cough is salutary, as stated, in that it dislodges and expels the cause of the disease with the matter expectorated from the lungs. It is of

bad omen when the cough is excessive and dry. In the presence of high fever, secretion is usually arrested and cough is unattended with expectoration. On the other hand, the expectoration may be excessive and may drain the strength of the patient. Excessive expectoration is checked especially by the use of creosote, and may be limited by inhalations of steam medicated with this, or by some antiseptic already specified. Turpentine, the ethereal oils, and oil of eucalyptus or balsam of Peru are other agents preferred by certain practitioners. When the secretion is excessive, Penzoldt prefers the inhalation of a 2 per cent. solution of tannic acid, which may be sprayed into the throat three or four times a day. The tongue should be withdrawn, as in the process of inspecting the larynx, and the spray should be used for a quarter of an hour before each meal and over a period of months.

Expectoration is of especial value as indicating the status of the disease. In this connection the following statistics and statements of the sputum examined in 4000 cases by Amann, of Davos, will be found of value. The examinations were derived from 1792 different patients:

Tubercle-bacilli were found in 1498 patients (83 per cent.): On the first examination, in 1027 patients (69 per cent.); on the second examination, in 291 patients (19 per cent.); on the third examination, in 105 patients (7 per cent.); on the fourth examination, in 59 patients (4 per cent.); on the fifth examination, in 11 patients (0.7 per cent.); after more than five examinations, in 5 patients (0.3 per cent.); 30 per cent. of cases required several examinations to demonstrate the bacilli. During the treatment there was observed among 856 cases a total and permanent disappearance of the bacilli from the sputum in 16 (1.7 per cent.); a sensible reduction in 144 (16.8 per cent.); a sensible increase in 254 (29.7 per cent.); no essential difference in the number in 442 (51.5 per cent.). The utmost efforts in all of these cases secured only a little mucus.

Temporary absence followed by reappearance of bacilli was observed in 66 patients (7.7 per cent.). Among 31 fatal cases, there was observed total disappearance of the bacilli in none; sensible reduction in 2 (6 per cent.); sensible increase in 21 (68 per cent.); no change in 8 (26 per cent.). In 7 cases the increase in the number of the bacilli was very remarkable; in 8 cases it was actually enormous. Of the 16 cases the bacilli entirely disappeared in 1 case in six weeks; in 2 cases in six months; in 4 cases in one year; in 4 cases in two years; in 3 cases in three years; in 1 case in five years; in 1 case in six years.

Elastic fibers occurred in 8 cases in which the sputum was continuously free of bacilli. Of these cases, 4 presented advanced bronchiectasis; 1 was a case of pulmonary abscess, and 3 were doubtful cases. It was not possible to find elastic fibers in the sputum in 167 cases (11 per cent.). The majority of these cases were in young people with incipient pulmonary tuberculosis, especially the so-called apical catarrh. In the remaining 1331 cases (88 per cent.) the sputum contained both bacilli and fibers, but the bacilli were found in the sputum of the same patient much more constantly than elastic tissue. In the 16 cases in which the tubercle-bacilli disappeared entirely, the sputum contained fibers in 5 cases,

and no fibers in 11 cases. In the 31 fatal cases, elastic fibers were found in every case, and in the majority of these cases in large numbers.

A definite cure of tuberculosis without a total and permanent disappearance of the bacilli from the sputum is inconceivable. The disappearance of the bacilli goes hand-in-hand with the cure of the case.

*Laryngitis.*—Tuberculous laryngitis is one of the most distressing complications of the disease, and in an aggravated form leads quickly to dissolution. The lymphatic vessels and glands about the larynx constitute a hotbed for the rapid spread of the disease. But if attacked early, tuberculous laryngitis has by no means the fatal prognosis of former times, and the distressing dyspnea, dysphonia, and dysphagia, which belong to aggravated cases, may be averted or obviated by timely treatment. Lactic acid is the remedy *par excellence* in the treatment of laryngeal tuberculosis. It attacks and destroys tuberculous tissue without affecting the healthy structures. It should be applied with the aid of the laryngoscope, with the laryngeal brush, or better, with the laryngeal forceps, and clean absorbent cotton, in the proportion of from 1 : 15 to 1 : 10. The proportion may be increased to 1 : 5 or even to 1 : 2, caustic solutions. A very sensitive larynx must be previously anesthetized by means of a solution of cocain, from 1 : 10 to 1 : 4. Trichloracetic acid is a much more powerful caustic. So long as the disease is superficial, that is, so long as the bacilli remain upon or just beneath the surface, they may be reached in this way. This treatment constitutes also the best address to ulcers of tuberculous origin. Very mild cases are often relieved by solutions of silver nitrate of a strength varying from 1 to 4 per cent., or with insufflations with sodium sozoiodol. Cases that have passed to the stage of deformity, with deep infiltration and destruction, call for the use of menthol, cocain, or morphin.

*Catarrh.*—Catarrh is an almost constant complication of tuberculosis of the lungs. Patients live in an infected atmosphere, and continuously inspire the cause of the disease. Moreover, infection is continuous from below in the matter expectorated. Physicians who practise especially in lung-diseases are themselves frequent subjects of this kind of catarrh. The condition is best treated by agents that remove the cause of the disease. Thus the nose and throat should be sprayed out under pressure with disinfecting solutions. A good preparation of this kind is furnished by the addition to a pint of distilled water of a dram (4.) each of borax and sodium bicarbonate. Boric acid, from gr. xx to xxx (1.3–2.) to the ounce (32.) of vaselin, and yellow mercuric oxid, from gr. v to x (0.32–0.65) to the ounce (32.), make good ointments for insufflation into the nose at bed-time. After spraying with a purifying and cleansing solution, boric acid in powder, or sodium sozoiodol, should be blown into the nasal cavities and pharynx. Proper cases call for the use of the galvanocautery.

*Hemoptysis.*—Hemorrhage, unless excessive, does not really aggravate the prognosis. Patients with hemorrhage live as long, as a rule, as those without, but hemorrhage is liable to be excessive. A patient may lose life by loss of blood, or he may be actually suffocated. More frequently death occurs very

slowly in consequence of anemia. However alarming at first, patients soon become reconciled to light hemorrhages, and scarcely pay enough attention to them to take the proper care of themselves. Some patients spit blood more or less continuously in small quantities, or regularly in conditions of greater fulness of the vessels, as after meals, early in the morning, more especially during or about the time of the menstrual period. Such hemorrhage has little or no definite significance. In the treatment of hemorrhage the first necessity is rest. The patient should observe absolutely the recumbent or semi-recumbent posture. He should not even be allowed to speak. In the presence of fever quinin should be administered in doses of five grains (0.32) every three or four hours until the hemorrhage ceases. Cough should be quieted by minute doses of opium, especially in the form of Dover's powder, which may be given in doses of two (0.13) or three grains (0.19), every two or three hours. As in other cases of hemorrhage, it is common practice to administer the fluid extract of ergot in dram doses (4.), every hour or two. This remedy acts, of course, upon the whole vascular system, but has much less effect upon bleeding from the lungs than upon that from the uterus and elsewhere. A remedy of much higher value is atropin, as first recommended by Traube. Of a solution of one grain (0.065) to the ounce (30.), from 3 to 5 drops may be given every three or four hours until the hemorrhage ceases or tolerance is reached.

In cases attended with fever it is good practice to administer ipecac after the method recommended by Stoll and Trousseau. Trousseau gave doses of 15 grains (1.) every ten minutes. Jaccoud prefers a smaller dose, to avoid vomiting, to wit, one or two grains (0.065–0.13) up to the point of nausea. The remedy is thus given at first every half-hour, then every hour, then every two hours, etc. Peter preferred antimony and potassium tartrate in small doses (gr. $\frac{1}{20}$) every two hours up to the point of inducing nausea, which causes an energetic contraction of the blood-vessels, and often quickly arrests hemorrhage.

Salt is a domestic remedy which has real scientific support in that by irritation of the mucous membrane it causes reflex contraction of the capillary vessels in the lungs. About a tablespoonful of salt is swallowed with as little water as is necessary to wash it down.

Digitalis in combination with potassium bromid acts well also in cases of hemorrhage with excitement, as at the menstrual period. Thus:

℞ Potassii bromidi, 10 grams (ʒijss);
Tincturæ digitalis alcohol., 50 drops;
Aquæ, 200 grams (fʒvjss).—M.
S. Two tablespoonfuls per day.

Inhalations of the so-called styptics, iron, lead, and tannic acid are not only useless but injurious.

In deference to custom an ice-bag is usually applied to the chest, and the patient is made to swallow small pieces of ice. Iced tea and iced lemonade are good drinks to allay the excessive thirst from which most patients suffer. A mustard-plaster applied to the chest often acts as a derivative.

Daremberg employs the principle of derivation in the treatment of hemoptysis, and recommends, in conjunction with the use of other well-known remedies, the application of ice to the testicles or to the labia majora. If the hemoptysis is repeated, the ice is applied to the external genitals twice a day, or is kept in contact with the skin for five minutes.

Bad cases may be rescued at times by the old process of ligation of the extremities. A ligature is put about the arms and legs, and is fixed with such degree of firmness as to prevent the entrance of arterial and the escape of venous blood. The accumulation of blood in the extremities empties the trunk, including the lungs, which are thus rendered anemic. The ligature is slowly loosened in the course of a quarter of an hour.

When there is great dyspnea with danger of suffocation, the best remedy is champagne. The physician must, in case of necessity, withdraw clotted blood from the throat and larynx. Many a patient has been saved in this way. Examination of the chest is to be avoided absolutely. Percussion itself may break down clots and cause renewed hemorrhage. It is nearly always impossible to find the source of the hemorrhage. The patient should remain in bed for a week after all trace of hemorrhage has ceased.

*Night-sweats.*—Night-sweats come and go in the history of the case, often independently of the gravity of the disease and sometimes uninfluenced by remedies. They are combated best by the administration of atropin after the method of Sidney Ringer, in granules of 0.5 mg. (gr. $\frac{1}{130}$), three of which are to be taken every three hours in the evening; or in a solution of one grain (0.065) to the ounce (30.), of which five drops may be taken in a teaspoonful of water at bed-time. Agaricin is a remedy of value to control night-sweats. It acts slowly, not before five hours, but its action is continued for as long as twenty-four hours. The drug should therefore be given early, at 5 P.M., in a pill, or in sirup in dose of 5 mg. (gr. $\frac{1}{12}$). When the night-sweats occur very late at night or very early in the morning, this dose may be repeated at midnight. Camphoric acid in doses of from two to three grams (gr. xxx–xlv) in wafers containing each one gram (gr. xv), taken two or three hours before the appearance of the sweats, is a remedy sometimes of great value. Sulfonal in doses of from one-half to one gram (gr. viiss–xv) taken one hour before bed-time, or trional in the same dose taken at bed-time, often produces sleep and prevents night-sweats. A sovereign remedy at times is strychnin, given by subcutaneous injection in doses varying from gr. $\frac{1}{50}$ to gr. $\frac{1}{25}$ (0.0013–0.0026).

Brehmer finds as the best preventive of night-sweats a substantial evening meal and the drinking of from one to three glasses of milk shortly before going to sleep. The milk may contain not more than three coffeespoonfuls of cognac. I find the best remedy in tuberculin given in small dose, one interspace of the $\frac{1}{20}$ of 1 per cent. solution every other day.

*Pain.*—Pain is sometimes due to a toxic neuralgia or it is an expression of anemia; more frequently it is pleuritic. In light cases it may be relieved by applications of hot water, ointments and plasters of belladonna, and sinapisms. Small doses of phenacetin, from three to five grains (0.19–0.32), may suffice

to quiet pain. Antipyrin has still more value, but in large doses it has the disadvantage of depressing the heart. Salol is safer than either of these two agents. It may be given in the form of powder, capsule, or compressed tablet, in doses of five grains (0.32) every two hours. Lactophenin is a perfectly safe drug in the same dose. Bad cases require morphin.

*Dyspnea.*—Dyspnea is always a grave sign. It usually occurs in connection with advanced lesions, and is often extremely distressing toward the end. It may be relieved by inhalations of oxygen. It is often quieted at once by ether, which may be administered internally in the form of Hoffman's anodyne, in doses of from one-half to one teaspoonful diluted with water or with wine. A mixture of camphor and acetic ether, 1 : 10, inhaled more or less continuously, affords the most relief. I have found the subcutaneous injection of a syringeful of a solution of camphor in oil of sweet almonds, 1 : 10, the most effective remedy. Sooner or later it may be necessary to resort to morphin, if only to secure euthanasia.

*Anemia.*—Anemia is best combated by iron, particularly by Blaud's pill, by saccharated iron carbonate with hydrochloric acid, or by iron with arsenic, as already mentioned.

*Dyspepsia.*—The sovereign remedy is hydrochloric acid, in doses of from 12 to 15 drops in a wineglassful of water before meals. Atony of the stomach is best overcome by the tincture of nux vomica, gtt. x–xx, or by strychnin.

℞ Strychninæ nitratis, gr. j (0.065);
Aquæ destillatæ, f℥j (30.).—M.
S. Five drops, increasing gradually to ten, three times a day.

Dyspepsia often disappears with regulation of the diet, especially with the use of buttermilk, koumiss, or kefyr. The occasional use of the stomach-tube with lavage yields more decided relief than any drug. Excessive nausea and vomiting may call for the use of chloral after the method already described, or of cocain in doses of from gr. ¼ to gr. ½ (0.016–0.032). Menthol sometimes renders good service:

℞ Menthol, gr. v (0.32);
Spiritus rectificatus, gr. x (0.65).—M.
S. Five drops in a tablespoonful of water before meals.

An excellent remedy is creosote, prescribed in the manner already detailed.

*Nausea* is best controlled by hydrochloric acid; if associated with diarrhea, by 10-grain (0.65) doses of bismuth. Bad cases call for the use of minute doses, one or two grains (0.065–0.13), of chloral. Nausea usually disappears after the use of creosote.

Orexin, which may be taken in a dose of five grains (0.32) in a cup of hot tea, especially beef-tea or chicken-soup, once daily, at about 10 A. M., will sometimes rouse an appetite when everything else fails.

*Constipation.*—Constipation attends most cases of pulmonary tuberculosis, and calls for the use of laxatives. A glass of mineral water, Vichy, Apollinaris, Carlsbad, or Blue Lick, before breakfast may suffice, or a teaspoonful of common salt or of sodium phosphate in a glassful of water may answer the same purpose. Among laxatives may be selected a compound pill of rhubarb after each meal, or a pill of podophyllin, from gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$ (0.016–0.032) at bed-time, or fluid extract of cascara half a teaspoonful after each meal, or a gelatin tablet of cascara after each meal, or a pill of aloin, strychnin, and belladonna. The slow injection and the retention of a pint of pure olive-oil at bed-time will be followed by a regular movement of the bowels the next day.

*Diarrhea.*—Diarrhea indicates more or less extensive ulceration, and occurs more particularly toward the close of the disease. It is best combated by regulation of the diet, and especially by the adoption of a milk-diet. Among the preparations of milk, malted milk deserves praise. The sovereign remedy is bismuth, in doses of from 5 to 15 grains (0.32–1.) from every two to four hours. With it may be combined salol in doses of five grains (0.32). A good remedy at times is beta-naphthol, which may be given every two hours in doses of five grains (0.32) in the form of keratin-coated pills, so as not to be dissolved in the stomach.

Bismuth subgallate, in doses of from 10 to 15 grains (0.65–1.), is sometimes of signal value. Dermatol in the same dose may succeed when everything else fails. These powders are best swallowed dry or with as little water as possible. In fact, but little fluid should be taken at any time when diarrhea exists. Pain calls for opium, which is best given in the form of a tincture, in doses of from 2 to 5 drops.

*Bed-sores.*—Bed-sores occur most frequently in neglected cases. They are more easily prevented than cured. The patient should be made to change his posture as much as possible. Close attention must be paid to the bed and bedding. The skin may be hardened by being washed with alcohol and water, 1 : 4. When the surface is broken, it should be dressed with an ointment of iodoform, or a solution of iodoform and ether, or collodion, which protects the raw surface by a film. When the odor of iodoform excites repugnance, this drug may be replaced by iodol, ichthyol, or aristol, all of which have, however, far less value.

The character of the treatment will depend largely upon the stage of the disease, that is, the outlook as furnished by a consideration of the various symptoms. Thus, limitation of the process to one apex makes a more favorable prognosis. When the dulness extends below the second rib the outlook is not so good. The existence of cavities makes the prognosis much more grave. Mere deformity, from shrinkage, which may represent cicatrization, is not unfavorable. As a general rule, the less cough the better; at the same time it must be admitted that some cough is salutary, as it aids in the elimination of disease-products. It must be remembered, however, that cough may be entirely absent in the latest and worst stages of the disease, in the presence of high hectic and profuse sweats. The absence of cough at this time is a bad

sign. A light degree of hemorrhage does not aggravate the prognosis, but severe or repeated hemorrhage makes the outlook bad. The recurrence of hemorrhage shows a spread of the disease.

The prognosis may not be determined so accurately by the number of bacilli in the sputum, though it may be said in a general way that the bacilli diminish in number as the condition improves in the lungs. The number of bacilli in a given specimen of sputum may be a matter of accident, so to speak. The worst form of tuberculosis, miliary tuberculosis, may show no bacilli at all.

The temperature furnishes the best criterion of the existing condition. The tubercle-bacillus alone may produce fever, but the peculiar septic fever which gives rise to what is known as the streptococcus-curve is characteristic rather of secondary or mixed infection. When the temperature in the evening does not reach higher than 100° F. (37.8° C.), the outlook is not so bad. Fever in the morning, with evening remissions, the so-called inverted type, is of ill omen. Sweating has but little influence upon the prognosis. As stated, sweats come and go in the history of tuberculosis under nervous influence. Sweats are at times obstinate; very frequently they disappear spontaneously. Sweating may show itself very early in the history of tuberculosis, in the so-called pre-physical stage of the disease and in the absence of fever. Sweats that occur in the night in this way should excite suspicion of tuberculosis, though they by no means always depend upon this cause. Profuse colliquative sweats more immediately precede the end. The prognosis is influenced by the condition of the heart; sometimes the heart is naturally small or it becomes weak and feeble as a result of degenerative processes. A small, weak heart gives a bad prognosis.

Complications on the part of the larynx, ulceration, perichondritis, deformity, intensely aggravate the prognosis. Most of these cases represent neglect of local treatment. Nevertheless the outlook of laryngeal tuberculosis is not so bad now as it was formerly. It was said formerly that a pronounced laryngeal tuberculosis allows the patient not longer than six months to live. As long as the appetite is good, the outlook is not bad; anorexia makes a bad prognosis. Constipation is the rule in the earlier stages of the disease; diarrhea occurs later, and results from ulceration. Diarrhea is dangerous according to its intensity and obduracy.

Much depends also upon the intelligence of the patient, whose co-operation is necessary to secure any good results. Finally, the prognosis is determined to large extent by the ability of the patient in a financial way to secure the suggestions of therapy regarding diet, leisure, climate, etc.

In the last stages of the disease euthanasia is secured only by the liberal use of alcohol and opium. Cases in this stage illustrate the effect of neglect of treatment in the early stages, for, as Cicero says, "Omne malum nascens facile opprimitur, inveteratum fit plerumque robustius," which is but a Latin paraphrase of the observation of Aretæus, the Cappadocian: "In chronic diseases the postponement of medical treatment is bad, for by procrastination they pass

into incurable infections, being of such a nature that they do not readily come off if they once attack; and if protracted by time they become strong, and end only in death."

*Scrofula.*—Scrofula is external tuberculosis—that is, tuberculosis of the skin and of the superficial tissues, especially the superficial lymphatic vessels and glands. External tuberculosis often illustrates many obscure points in connection with tuberculosis, and especially emphasizes the long quiescence of the disease with subsequent recurrence or relapse. It illustrates also the mode of ingress. Strauss injected the nasal mucus of 29 healthy people, who were in contact with tuberculous patients in hospitals, into the peritoneum of guinea-pigs: 7 of these animals died of suppurative peritonitis; 13 remained healthy; 9 died tuberculous, or were killed after a few weeks and found tuberculous.

In these cases the bacillus is still outside the body, as much as if it had never been inhaled at all. In other cases the bacilli lodge upon the tonsils, and penetrate to the nearest lymph-glands. They may enlarge these glands and go no further, or they may advance to implicate other glands, and, thus, deeper and deeper structures, until they reach the lungs.

Dieulafoy injected a series of guinea-pigs with parts of the tonsil of man. Of 61 animals so treated, 8—that is, 13 per cent.—were affected with general tuberculosis. Pieces of adenoid exuberations on the tonsils were injected into 35 guinea-pigs. Of these, 7—that is, 20 per cent.—became tuberculous. Hence the author declares that the tonsils in a certain number of cases introduce the tubercle-bacillus into the body, and that the lymph-vessels and cervical glands become gradually affected on the way to the lung. But a small primary break in the epithelium is necessary to effect this result.

Cornil repeated these experiments, but was not able to confirm the conclusions to the same extent. He got, in the examination of 70 cases, only 4 positive results, and then the conclusions were established by means of giant-cells without the discovery of the tubercle-bacillus. Thus, Cornil got conclusions in 17 cases, while Dieulafoy put the proportions at 1 : 5. Cornil likewise examined sections of the parts, while Dieulafoy based his conclusions simply upon experiments upon animals. Cornil claims that it is impossible to say, in the injection of parts of the tonsils, that outside matter was not adherent, and tubercle-bacilli may have been laid on the surface and in the interstices, crevices, and follicles on the tonsil. Thus is explained the difference in the conclusions; but the general result is in no way invalidated by this fact.

Several years ago it was shown, in examinations made at school, that children with carious teeth are much more liable to be affected with tuberculosis than children with sound teeth. The treatment of scrofula must include, therefore, address to the throat and mouth.

Hallopeau distinguishes a primary and a secondary tuberculosis of the skin. The secondary variety follows disease of the more deeply lying organs. The forms of the primary variety are: (1) Lupus vulgaris, in which the disease

affects only the corium; (2) Tuberculosis verrucosa cutis, a tubercle of the skin in which the papillary body is the seat of the disease; (3) Lichen scrofulosorum, that is tuberculosis of the sebaceous glands; (4) Lupus erythematosus, which is included among tuberculous diseases because it is often found in individuals who show lupus vulgaris or other tuberculous affection, but here it is the hair-follicles that are the seat of the disease. Hallopeau speaks of remissions that occur in the course of treatment of tuberculosis of the skin, and that often show an apparently perfect cure for a very long time. He cites cases in which relapses took place at intervals of from twenty-five to forty years and more. His conclusions are as follows: Shorter or longer remissions occur in all forms of tuberculosis of the skin. Definite cure is observed oftener in lichen scrofulosorum and secondary skin-tuberculosis, but is most rare in tuberculosis cutis verrucosa. The recurrences prove that remissions are due only to a longer quiescence of the cause of the disease in the tissues, and relapses to a further development in a soil rendered fertile from an as yet unknown cause. The same thing is seen in lepra.

Secchi reported a case of lupus erythematosus in which the injection of tuberculin was followed by both local and general reaction, and which was finally cured under this treatment. On this account, and on account of the histologic condition, this authority believes that lupus erythematosus is only a variety of lupus vulgaris, notwithstanding the negative bacillary findings.

The treatment of external tuberculosis does not differ in a general way from that of the internal affection, save that the disease, being on the outside, may be more readily reached by local means. Thus, Hallopeau has observed a favorable influence from an attack of erysipelas upon the course of skin-tuberculosis. He believes that the streptococcous invasion so changes the constitution of the skin that it no longer furnishes a good culture-soil for the tubercle-bacillus. He does not hesitate to recommend artificial inoculation as a therapeutic measure, as erysipelas is a trivial and temporary affection in comparison with lupus.

Enlarged lymphatic glands often disappear entirely under the use of minimum doses of tuberculin, and under the general hygiene of the supporting treatment. The old practice consists in the routine administration of iodin:

℞ Potassii iodidi, ʒj (32.);
Aquæ menthæ piperitæ, ad fʒj (30.).—M.
S. Five drops in a wineglassful of milk.

Iodin is also applied externally in the form of the simple or compound ointment. Treatment with iodin alone fails oftener than it succeeds. Resort is next had to intra-parenchymatous injections.

Nélaton had reported remarkable results in the resolution of enlarged lymph-glands by injection of naphthol-camphor. Unfortunately Berger was unable to confirm these results in all cases, and he sometimes saw the development of gangrene of the skin. The drug was sometimes introduced through

a puncture of the skin. The great advantage of this treatment is found in the fact that it leaves no scars. Tuffier rejected all methods of treatment of tuberculous adenitis in children, including the interstitial injection of iodoform-ether, iodoform-glycerin, zinc chlorid, carbolic acid, and Van Swieten's fluid. Good general treatment, with eventual extirpation of the glands, possesses great advantages over all other methods, notwithstanding the fact that extirpation often leaves ugly scars. Interstitial injections are sometimes followed by thickening of the periglandular tissue, which necessitates eventual extirpation. I would urge the absolute extirpation of all accessible glands.

Scrofulous ulcers are best treated by the method of Fabry, that is, by the internal administration of arsenic and by the application of a bandage moistened with equal parts of lead-water and carbolized water, the bandage to be covered with oiled silk or gutta percha. To the indurated glands not yet softened is applied with brisk friction the following ointment:

℞ Unguenti hydrargyri,
Lanolini,
Olei olivæ,
Vaselini, *āā* 15.—M.

By this means scrofulous ulcers are made to cicatrize, and with long-continued, conscientious massage indurated glands are brought to resolution. A more obstinate scrofuloderm of smaller size, with one or a few more deeply lying gland-nodules, is cured only by thorough surgical extirpation.

Mosetig-Moorhof recommends teucrin in the treatment of local tuberculosis. He believes that hyperemia always exercises a favorable influence on local mycoses. Thus an erysipelas may cause a malignant tumor to disappear, and celiotomy may cure a peritoneal tuberculosis. The good effects of silver nitrate reach beyond the seat of its immediate application. Parenchymatous injections of zinc chlorid act in the same way.

Teucrin is an extract of the Teucrium scordium, and is somewhat difficult of preparation. The teucrium belongs to the family of the Labiaceæ of Central Europe. Dioscorides vaunted its anti-fermentative properties. Moorhof employed teucrin by subcutaneous injection in the neighborhood of a disease-process. The temperature rises in three or four hours after the injection, reaching a maximum of 40° C. (104° F.). This elevation is sometimes accompanied by a short chill. The fever is, however, entirely of the aseptic type. The patient maintains his euphoria, the skin remains moist, the tongue is normal; there is no disturbance of appetite and no thirst; the secretion of the kidneys is not affected. The secondary effects consist in a congestion more or less pronounced at the seat of the lesion. This congestion is increased in the course of the first two days following the injection, but it is always apparent on the first day. The local effects are marked. A cold abscess is converted into a warm abscess in forty-eight hours. The indolent, painless abscess becomes sensitive to pressure and even painful. It diminishes in size in consequence of ab-

sorption of serum and condensation; the hyperemia lessens; the abscess may be cicatrized in from six to eight days. Abscesses of bone require a longer time.

*Meningitis.*—Meningitis is an episode in the life of a tuberculous patient. The condition is never primary, and is often found in connection with manifest signs of tuberculosis. The treatment of tuberculous meningitis remains a dark chapter in the history of medicine, though it may no longer be said that cases absolutely never recover. The therapy is wholly symptomatic. Excessive irritation is allayed by the bromids and by chloral after the manner already specified. Constipation is overcome by calomel. Insomnia may be counteracted by trional. The application of iodoform-ointment, one dram (4.) to the ounce (32.), to the shorn scalp, as recommended by English authorities, is welcomed more as a contribution *ut aliquid faciat*, than in any hope of real rescue. I have seen bad cases rescued now and then by tuberculin—unless a mistake has been made in the diagnosis, which was twice at least confirmed by other practitioners.

*Pleurisy.*—In support of the view that adhesions of the pleura are for the most part to be referred to tuberculosis, Schlenker publishes the result of the examination of fifty-seven cases of adhesions of the pleura. In thirty-three cases, that is, in 57.89 per cent., tuberculous lungs or bronchial glands could be demonstrated on macroscopic examination, so that in these cases the adhesions could probably be referred to tuberculosis.

Ferdinand Ludwig, prince of Bavaria, made bacteriologic examination in 23 cases of pleuritic effusion, and found the exudation serous in nine cases. In two of these cases staphylococci were present; in two, pneumococci; five were free from bacteria. Of the last, four were tuberculous; the fifth developed after influenza, but in this case tuberculosis had also to be considered. The exudation was sero-purulent in one case; in this case pneumococci were present. The exudation was purulent in twelve cases; in two of these pneumococci were present; in five, streptococci; in two, tubercle-bacilli; in two, diplococci and streptococci; in one, staphylococci and streptococci. In one the exudation was ichorous; in this case there were present, besides the proteus and sarcinæ, staphylococci. The following conclusions are announced:

1. The majority of cases of serous exudation are free from bacteria.

2. The majority of the exudations free from bacteria are of tuberculous origin. [This fact is proved by the results of inoculation of animals.]

3. Certain serous exudations, though they contain the micro-organisms of pus, nevertheless remain serous.

4. This statement does not hold good for the exudations containing streptococci.

5. The majority of cases of empyema are caused by the streptococcus pyogenes, but some of the cases are due to other pus-micro-organisms.

6. Infection of the pleura occurs in the majority of cases in consequence of such a lesion of the lung-tissue as permits the penetration of causative or accompanying pyogenic organisms into the pleural cavity. At the same time

the possibility of exudative pleurisy of toxic or mechanical origin must be admitted.

The treatment of tuberculous pleurisy does not differ from that of pleurisy from other cause. Fever, with its associated symptoms, is combated by the use of sodium salicylate, according to the method suggested by Fiedler. Pain is relieved by hot embrocations, and if severe, by opium, especially by Dover's powder in broken doses. When the course of the disease is unduly protracted, the fluid may be withdrawn by aspiration, a practice that suffices also to relieve the empyema of children. Purulent accumulations in adult life demand paracentesis, with resection of a rib. The opening is plugged with iodoform-gauze, which is removed morning and evening to permit the cavity to drain. Irrigation is no longer considered necessary or advisable. Further details of treatment will be found elsewhere.

*Peritonitis.*—Tuberculous peritonitis is more common than is ordinarily believed. Münstermann found in 2837 sections made in the Pathological Institute of Munich, during four years, tuberculous peritonitis forty-six times (1.6 per cent.), although in only one case was there primary tuberculosis of the peritoneum. Borchke observed, in 226 cases of tuberculous peritonitis in the Breslau Pathological Institute, only two cases of primary nature. The disease is most frequent in youth. It is rare before the age of forty years. Münstermann found the greatest mortality between thirty and forty. Sex has not much etiologic influence, though men are more commonly affected than women. In women, according to Fehling, tuberculosis of the sexual apparatus, especially of the tubes, is not infrequently the originating center. The outbreak is facilitated by certain circumstances, such as injuries of the peritoneum and alcoholic abuse (Eichhorst).

Berggrün and Katz call attention to a symptom hitherto but little observed, but very frequent and therefore of important diagnostic value: the occurrence of uncolored, acholic stools. The condition is not really one of acholia, as the bile is poured into the bowel in sufficient quantities, but its action is altered in a peculiar way, so that "while its antiputrid properties are still preserved, its effect on the digestion of fat is diminished." The stools look clear and colorless because they contain an abnormally large amount of fat.

Serous tuberculous peritonitis runs a chronic course, constituted of a succession of acute peritonitic attacks. Sometimes it develops so insidiously as to be considered an ascites, and to lead to the false diagnosis of cirrhosis of the liver or thrombosis of the portal vein. In reduced patients and in alcoholics the diagnosis may be impossible, or can be made only by the demonstration of tubercle-bacilli in other parts of the body, or of tubercle-bacilli in the fluid withdrawn by puncture, though the absence of tubercle-bacilli does not exclude tuberculous peritonitis. Usually the diagnosis is based upon hectic, pain, emaciation, and diarrhea.

The dangers are great, through occlusion of the intestine, through strangulation, through hemorrhage, marasmus, and general tuberculosis. But in

recent times the prognosis has become much more favorable in consequence of resort to celiotomy. Much cannot be hoped for from internal medication. Most is accomplished by large doses of calomel in furthering diuresis. Inunctions with mercurial ointment, with green soap, and the use of the sweat-box, are recommended. Under this treatment exudations sometimes disappear entirely, so that the thickly rolled omentum can be felt above the viscera. In hemorrhagic cases, the effusion of blood may be so sudden and so profuse as to lead to syncope, acute anemia, etc. (Eichhorst).

Much more to be recommended than any internal treatment is the practice of celiotomy. Spencer Wells performed the first operation in 1862. It was done on the basis of a false diagnosis, for the disease was believed to be an ovarian tumor. The woman recovered from the operation, married four years later, and was still healthy at the end of twenty-seven years. Since this time incision has often been made in cases of tuberculous peritonitis, with good results. The cavity emptied by puncture sometimes soon refills, even if an irritating fluid is injected into the cavity.

Celiotomy furnishes the following results: König collected, up to the year 1890, 131 cases of abdominal section for peritoneal tuberculosis. In 24 per cent. recovery ensued and continued for more than two years; in 65 per cent. for less than two years; in 3 per cent. death took place as a result of the operation. Whether the section alone suffices, or whether the primary tuberculous organ, the lymphatic glands, the tubes, shall be also removed, are points of dispute among the surgeons. König advocates the section alone, while Czerny removes at the same time, if possible, the primary tuberculous center.

Adossides tabulates 405 celiotomies undertaken for tuberculous peritonitis, and communicates six new cases from the surgical clinic of Prof. Bramann. The whole mortality of the 405 cases amounted to 27 per cent., of which 10 per cent. were due to the direct effect of the operation. In children, 66 per cent. were females; in adults, 90 per cent. were females.

Recovery ensued—

| | In adults. | In children. |
|---|---|---|
| In the exudative form | 73 per cent. | 84 per cent. |
| In the dry, so-called plastic, form | 62 " | 62 " |
| In forms with ileus | 23 " | 30 " |
| In suppurative forms | 50 " | 72 " |
| In forms with congenital tuberculosis | 63 " | |

The operation must be performed with the greatest care, as loops of intestine may be adherent to the anterior abdominal wall and may be accidentally cut. Some surgeons are content with the opening of the abdomen and discharge of the fluid; others follow the operation with irrigation with a solution of salicylic acid, etc.

Poncet reports three cases of cure of tuberculous peritonitis by celiotomy, after six, seven, and twenty-four months respectively. The last case, in a patient aged eighteen years, is especially remarkable because the same operator had

occasion two years after the operation to again open the abdomen for the relief of a traumatic abdominal hernia, when he found entire restoration of the peritoneal surface. In the first operation there was marked ascites. The intestines and the parietal peritoneum were strung with large and small granulations, inoculation of which in a guinea-pig produced tuberculosis. All three cases made perfect recoveries.

Nannotti and Bacciocchi, after producing peritoneal tuberculosis in rabbits by the intra-peritoneal injection of tubercle-nodules, from guinea-pigs, emulsified with sterilized bouillon, subjected the animals to celiotomy. In order to observe the effect of the first operation, which was associated with subsequent irrigation of the abdominal cavity, the animals were subjected to repeated celiotomies at intervals of ten, twenty, thirty, and sixty days, in order that the abdominal organs might be progressively studied. Moreover, a piece of omentum was exsected every time, and subjected to microscopic observation. It was found that celiotomy exercised no inhibitory influence on the development or progress of the tuberculous process in rabbits. But the case was different with dogs, as in every instance within two months after celiotomy the peritoneal tuberculosis disappeared, with the exception of a few tubercles on the convexity of the liver. The good influence of celiotomy was not observed to be increased by irrigation of the peritoneum.

The influence of abdominal section upon peritoneal tuberculosis is not clear. Lauenstein believes the good effect to be due to the drying and the influence of daylight on the tubercle-bacilli, a view that has found but few advocates. It is possible, as Henoch says, that the process is often a simple chronic peritonitis, with the formation of small fibroids, and is not tuberculous. Nevertheless, sufficient evidence has been adduced in favor of cures of certainly established tuberculous peritonitis as a result of abdominal section. Ceccharelli suggested the view that celiotomy with subsequent irrigation gives rise to irritation of the peritoneum and thus leads to a fibrous change of the tubercle-nodules, with encapsulation. Bumm recently made an accurate microscopic study in such a case, and found the process similar to that of an artificial inflammation. The tubercles were shrivelled and converted into small, firm masses of connective tissue. A round-cell infiltration surrounded the tubercles and penetrated into their interior. The giant-cells of the tubercles were partly broken up and partly destroyed, and bacilli could no longer be demonstrated.

Grawitz showed that the lymph-vessels quickly remove micro-organisms, but if the quantity is great so that they cannot be removed, or if absorption is hindered by thick fluids, or if there is trauma, cold, marasmus, or alcoholism, the disease develops. The withdrawal of the fluid may set the absorbents free.

As a substitute for an extensive celiotomy, Mader contents himself with puncture by means of a trocar, and the application of a bandage, to secure adhesion between the layers of the peritoneum. To prevent rapid refilling, he limits the amount of food and drink to a minimum, and gives opium in order to put the bowel at rest. To prove, however, that the mere discharge

of fluid does not effect the result, and that the contact of air is the necessity, Nolen found that simple puncture did not suffice, but that if warm sterilized air was injected through the puncture by means of a simple apparatus, the fluid did not accumulate. This operation is performed without narcosis. When the cavity refills the operation must be repeated.

Kummel cured a case with tuberculin after relapse following celiotomy, but Helmrich reported unfavorable results from this method.

Regarding peritoneal tuberculosis in children, Konitzer reaches the following conclusions:

1. Peritoneal tuberculosis is spontaneously curable in the dry form as an exception, but in the exudative form in a large number of cases.

2. The cases spontaneously curable have heretofore been regarded as examples of simple chronic exudative peritonitis or of essential ascites.

3. All forms of peritoneal tuberculosis may be cured, or at least improved, by celiotomy, even though internal therapy and puncture have been unattended with result.

4. The success of the operation depends (*a*) upon the form of the disease, as the best results occur in the most chronic cases; (*b*) upon the duration of the disease; (*c*) upon complications.

5. The operation is indicated, even though internal therapy has produced no improvement.

6. It is contra-indicated in children very much reduced, or who suffer from grave tuberculosis elsewhere.

7. The *modus operandi* of cure effected by celiotomy is, up to the present time, beyond solution.

*Tuberculosis of the Intestine.*—Frerichs found in 250 cases of chronic pulmonary tuberculosis, tuberculous involvement of the ileum in 80 per cent., of the colon together with the ileum in 45 per cent., of the colon alone in 3 per cent., and of the rectum in 7 per cent. Herxheimer gives the association of pulmonary tuberculosis with intestinal tuberculosis as 90 per cent. The disease is carried to the intestine by the deglutition of tuberculous sputum in adults, and in children by the ingestion of tuberculous milk. The prominent symptoms may be summed up as diarrhea with discharges of blood or pus or tissue-débris, pain, and peritonitis. Whenever, in a doubtful and obstinate case, six or more thin discharges occur per day, ulceration is to be suspected rather than simple catarrh. Blood is absent in the great majority of cases, and its infrequency stands in marked contrast to its frequency in dysenteric and typhoid discharges. Pain is an uncertain sign, and its absence does not exclude the disease. Perforation is a much more significant sign. The tuberculous ulcer often runs a latent course (Rosenheim).

Among the drugs to be recommended especially in the treatment of intestinal tuberculosis are creosote, bismuth, dermatol, salol, hydronaphthol, silver nitrate, calumba, lactic acid, and magnesium silicate. The effect of all of these is uncertain and transitory; sometimes one, sometimes another, succeeds. The pain of peritonitis is relieved by rest, heat, eventually a narcotic, and by deriva-

tives applied to the skin, vesicants, iodin-ointment, sapo viridis. Ulceration that may be reached, as in the rectum or at the anus, should be treated with the sharp spoon or with the thermo-cautery of Paquelin.

*Tuberculosis of the Bladder.*—Tuberculosis of the bladder is rare. It is most frequent in men, rare in children, but has been observed in children between four and seven years of age. The seat of preference is at the *bas fond*, near the orifices of the ureters, on which account pyelitis and pyonephritis so frequently occur in the course of the affection. The diagnosis is assured by the demonstration of tubercle-bacilli in the filtrate of the urine, but, as the bacilli are not present at the beginning, a negative disclosure does not exclude the disease. Death usually occurs in the course of a "cachexie urinaire," and not from tuberculosis of the lungs. Treatment is of little value except for the relief of symptoms, and this is best accomplished with local antiseptics and narcotics. No one as yet seems to have tried tuberculin under these circumstances. I have used this remedy faithfully in one case, but without effect. In this case it was impossible to find bacilli in the urine, which was often white with pus, so that the diagnosis was not positive.

# SYPHILIS.

By ORVILLE HORWITZ.

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**General Remarks.**—Whilst the actual character of the poison causing syphilis is unknown, the resemblance of the disease to others that have been proved to be of microbic origin gives us the right when treating syphilis to infer that we are dealing with an affection caused by the inoculation of a specific micro-organism.

Syphilis is naturally divided into three stages: primary, secondary, and tertiary. The treatment, therefore, is properly considered under the different methods to be pursued under these conditions, with their complications.

As the lesions that appear upon the skin and mucous membranes are benefited by direct applications, the treatment of syphilis is to be considered under local and constitutional methods.

**Primary Syphilis.**—*Local Abortive Methods.*—These are: (1) Excision with cauterization; (2) cauterization; (3) hypodermic injections of mercury; (4) the antiseptic treatment.

*Excision with Cauterization.*—There is still a doubt in the minds of many syphilographers, and one that has given rise to a great deal of controversy, as to the expediency of attempting to abort the disease by excision, with the destruction of the chancre and the parts immediately surrounding the sore, by means of cauterization, even if seen within four days after its first appearance.

In my opinion the appearance of the initial lesion is nothing more than the first symptom of the disease; its occurrence is coincident with a constitutional infection with a specific poison which must necessarily run its course. The abortive treatment has from time to time been brought to the notice of the profession by its advocates, only to be discarded after trial, its results having invariably been found negative; but from the recent researches of Bouchard and Chauveau, which seem to prove that the severity of the disease is in direct proportion to the intensity of the infection, and the belief of Finger that "the innocuity in the primary stage is due to tissue-products of the virus in the circulation, the infected foci being still strictly localized; the severity of the syphilis being due to the dosage of the poison," it would seem that the abortive treatment may be adopted as a matter of routine practice in certain cases. My experience with this method of treatment agrees with that of other observers. In 26 cases that came under my care within from two to four days after the appearance of the sore, and in which the lesion was situated in a suitable position for removal, I excised the chancre and cauterized the wound; of

this number 24 developed constitutional syphilis. In 18 of these cases I was able to examine the women from whom the disease was contracted, and found them to be syphilitic. In some of the cases constitutional symptoms were delayed—a not unusual occurrence when no attempt at treatment has been made. In all of the cases the secondary symptoms were mild, but by consulting the register of the Genito-urinary Clinic of Jefferson Medical College Hospital for a year, it was found that of 291 cases of secondary syphilis, in all save one the symptoms were of a mild type; so that it might readily be inferred that at the present time a mild form of the disease is the rule instead of the exception. In the two cases in which syphilis did not develop the diagnosis was probably erroneous.

It is doubtless the daily experience of those specialists who have the opportunity of seeing many cases of venereal disease to have brought to their notice sores that present the aspect of typical chancres, and yet are followed by no constitutional symptoms. This would seem to prove that one cannot be positive that a patient has contracted syphilis unless secondary symptoms appear.

Notwithstanding the fact that my experience with the treatment of the initial lesion of syphilis by excision and cauterization has been negative, and that I have but little faith in the theory that, if seen early, excision of the chancre will abort the disease, the statements of the eminent authorities already referred to are so positive that it is clearly proper, should the patient be willing to submit to the experiment, to give him the benefit of the doubt and attempt to abort the disease, provided the case is seen within from two to four days after the appearance of the initial lesion; that is, if the chancre is situated on a part of the penis where removal will not be followed by deformity or injury to the part, and if it is possible by confrontation to examine the woman and she be found to be syphilitic. This treatment is fairly applicable to those cases in which the lesion shows a marked tendency to spread and destroy the parts.

The operation, though slight, is attended with a great deal of pain, which may, however, be lessened by freezing the part by the application of ethyl chlorid or by injecting hypodermically into the base of the chancre a 4 per cent. solution of cocain.

The instruments having been properly prepared, the sore and surrounding skin should be rendered aseptic, when the ulcer is to be removed by an elliptic incision. Another method, to which preference is given, is to pick up the skin on one side of the sore by means of a rat-toothed forceps, and with a pair of scissors, curved on the flat, rapidly dissect it off. For a little while the bleeding is free, but it is easily controlled by hot water and pressure; a ligature is seldom necessary. When the bleeding has ceased, the part is to be washed with a 1 : 2000 solution of mercuric chlorid, then carefully dried with cotton and touched with pure nitric acid. The wound must be dressed with dry mercurial gauze. Sometimes slight edema follows the operation; this is easily subdued by the application of lead-water and laudanum. As a rule the wound heals readily.

*Cauterization.*—Cauterization manifestly does not offer as much chance for the patient as excision, as the entire seat of the infection may not be destroyed by the escharotic. This method of treatment gives rise to a good deal of local disturbance, retards the healing of the chancre, and increases the induration. Fuming nitric acid, potassium hydroxid (neutralizing its excessive effect with vinegar), pure carbolic acid, and acid mercuric nitrate are the escharotics usually employed. The practice of this method of treatment is, however, not recommended.

About two years ago I cauterized a tear of the frenum of a man who presented himself within an hour after the injury was received in the course of cohabitation with a woman of the town. He was greatly worried from fear of having contracted syphilis, and at his earnest solicitation cauterization was practised. The sore did not heal kindly, and at the end of the third week it was much indurated, and subsequently secondary syphilis was fully developed.

*Hypodermic Method.*—Bronson has recently advised the aborting of the disease by hypodermic injections of a mercurial into the chancre and the indurated lymphatic glands. This recommendation is based upon the theory that the initial lesion is the storehouse of the syphilitic poison, or the focus, during the primary stage, whence the disease is disseminated, and that the mercury, being brought into direct contact with the micro-organism that causes syphilis, necessarily exerts its germicidal influence, and thus aborts the disease.

Whilst for reasons to be stated hereafter the use of mercury is not advocated until the secondary symptoms have made their appearance, yet with a view to testing the efficacy of this method of treatment, ten cases were selected, and a quarter of a grain (0.016) of corrosive sublimate was daily administered hypodermically in each case until thirty injections had been employed. It was only possible to insert three or four injections at the site of the chancre; the rest were introduced into the indurated glands in the groin. This treatment was attended with slight pain, and with more or less edema of the penis. A suppurating bubo made its appearance in one instance only; whether this was caused by the treatment or not could not be determined, as a certain proportion of syphilitic cases will always present a complication of this kind. In nine of the cases the symptoms were delayed and did not appear for a period varying between two and nine months after all treatment had been discontinued. The manifestations were very mild, taking on the form principally of mucous patches, slight alopecia, and macular eruptions. In the tenth case, although considerably over one year has elapsed since the disease was contracted, no secondary symptoms have appeared. Doubt as to correctness of diagnosis must be taken into account in considering this case; it may not have had a syphilitic origin.

This method of treatment is not recommended, for, as far as can be determined, it simply delays the appearance of the symptoms and mitigates their severity, rendering it difficult to give a correct prognosis, and leaving it uncertain in the mind of the practitioner how long to continue treatment.

*The Antiseptic Method.*—This method of treatment is of but little value,

for in ulcers of syphilitic origin there is usually very slight suppuration, and the employment of antiseptics can only affect the pus-producing microbes on the surface of the sore; hence they can have little or no influence in checking the disease; besides, the local lesion often heals more readily when other methods are employed, the antiseptic solution frequently acting as an irritant and thus retarding the progress of the case.

**General Treatment of Chancre.**—There is no plan of treatment applicable to all the different varieties of chancre; the conditions attending each sore must be studied, and the remedies employed should be chosen to meet each indication as it arises. Whenever it is found that the method adopted is not proving beneficial, that it is acting as a source of irritation, or that the initial lesion is indolent, the application must be made stronger or weaker as may be found necessary, some new ingredient added, old ones discarded, or entirely different remedies employed. The fact cannot be too strongly emphasized that all harsh applications will be productive of harm, intensifying inflammation, giving rise to irritation and pain, and sometimes increasing the size of the ulcer.

One of the most important factors in bringing about speedy convalescence is thorough cleanliness, care being taken to protect the parts from irritation and the friction of the clothing. The patient should be directed to dissolve a teaspoonful of common salt in a cupful of water, and to soak the penis in this solution for a period of ten minutes three times in the twenty-four hours. Potassium chlorate, in the proportion of 3 grains (0.19) to the ounce (30.) of water, makes an excellent substitute for the salt and water. After washing the part, the sore should be carefully dried by means of a piece of absorbent cotton, the patient being instructed not to wet the surface of the ulcer, to avoid breaking the delicate granulations, and thus delay healing. It should then be dressed with any simple unirritating powder. An excellent combination is:

℞ Hydrargyri chloridi mitis,
Bismuth subnitratis,
Talci, āā ʒiij (12.).—M.

This should be dusted well upon the part and the chancre covered with a piece of cotton. The dressing should be changed three times daily. The patient should be instructed in removing the cotton always to soak it with warm water when found to be adherent, as forcible detachment may injure the tender granulations.

The local use of aristol has many advocates, but after large experience its employment is not advised, as it acts as an irritant, producing a serous discharge, often giving rise to erythema, increasing the local inflammation, and frequently retarding the cure.

Iodoform is also largely used, but I have never found its employment necessary in uncomplicated simple sores. Its odor not only makes it most objectionable to many patients, but arouses a suspicion in the minds of those with whom

they may come in contact, as to the character of the malady with which they are suffering. Iodol and iatrol are excellent substitutes for iodoform; they both contain as much iodin as iodoform and possess the advantage of having no perceptible odor; their use is highly recommended.

In the non-ulcerating papular variety of chancre, no dressing is, as a rule, necessary. The papule should be protected from injury by covering it with a bit of cotton to be kept in place by means of collodion; should ulceration supervene it may be treated in the manner already described.

If the lesion does not respond promptly to the use of powders, liquid preparations should be had recourse to. One of the best applications is black wash, a pledget of lint or cotton being moistened with the liquid and applied to the ulcer. Yellow wash answers the same purpose, but, as a rule, it should be reduced to one-half its officinal strength, otherwise it may prove too irritating.

In that rare form of the affection known as the "herpetiform chancre," cleanliness and the application of black wash give the best results.

"Mixed infection," that is, the occurrence simultaneously of chancroid and chancre will sometimes be met with. This condition should be treated in precisely the manner here set forth, except that it is well in these cases to touch the ulcer with carbolic acid. Europhen dusted on the part is often of value in controlling the suppuration, specific treatment being instituted as soon as constitutional symptoms make their appearance.

The deeply ulcerated indurated sore, known as the "Hunterian chancre," should be cleansed by means of a spray of hydrogen dioxid, and carefully dried with cotton touched with tincture of ferric chlorid; a piece of cotton on a stick being used for the purpose. After this it should be wrapped in cloths soaked with a solution of nitric acid, 2 drops, in distilled water 1 ounce (30.); or red wash may be employed, which consists of zinc sulphate 6 grains (0.39), spirit of rosemary, and compound tincture of lavender, of each 1 dram (4.); distilled water 6 ounces (180.). If the subject is a patient in a hospital, iodoform makes one of the best dressings; if not, iodol may be used.

If the chancre is indolent and does not heal, stimulation must be resorted to. There are many remedies employed for this purpose; one of the best is a solution of 30 grains (2.) of silver nitrate to the ounce (30.) of water, applied by means of a pledget of cotton every second or third day. Another remedy in constant use is mercuric nitrate 1 part, water 12 parts. A solution of 10 grains (0.65) of copper sulphate in an ounce (30.) of water is a very popular application. The tincture of ferric chlorid will frequently be found of much service. Great care must be taken not to over-stimulate the ulcer, and thus light up inflammation and run the risk of increasing the size of the sore.

When the powders or liquids here recommended do not benefit the patient, which, unfortunately, every now and then occurs, much good may be derived from the use of ointments. As a rule, their general employment is not recommended unless the sore will not yield to the treatment already laid down. The patient must be carefully instructed how to manage the sore, and especially directed not to let the salve remain too long in contact with the part, lest it

become rancid, and cause greater injury than benefit. A good formula which is highly recommended is:

℞ Unguenti hydrargyri nitratis, ℈j (1.3);
Unguenti iodoformi,
Balsami Peruvianæ,
Unguenti belladonnæ,
Unguenti zinci oxidi, āā ʒij (8.).—M.

Another useful stimulating ointment consists of—

℞ Unguenti hydrargyri nitratis, ʒss (2.);
Unguenti petrolei, ℥ss (16.).—M.

An excellent salve for hastening cicatrization contains—

℞ Unguenti hydrargyri oxidi rubri, ʒ⅛ (0.5);
Unguenti petrolei, ℥ss (16.).—M.

The patient should be instructed to dress the part at least twice daily. The ointment that adheres to the chancre should be removed each time by means of a pledget of cotton moistened with sweet-oil, which has the effect of softening the salve. The part should then be bathed in warm water, to which may be added 5 grains (0.32) of boric acid to the ounce (30.) of the fluid. The ointment is then to be reapplied.

It is a curious clinical fact that indolent venereal ulcers situated upon the body of the penis do better under the influence of stimulating salves, whilst those on the glans, or just back of the corona glandis, yield more readily to stimulating liquids, such as yellow wash, nitric-acid lotions, or a very dilute solution of acid mercuric nitrate. The reason for this is not understood.

Many additional remedies are recommended and employed in the treatment of chancre; some of them are of recent origin, and their merits have not yet been fully tested; they come to us, however, recommended by the highest German authorities. Those that I have employed have not proved any more efficacious than the substances already named, but that everything may be embraced that appears to have any real value, a few words will be devoted to each article:

*Bismuth subiodid* has been in vogue for a long time. I have employed it extensively, but have failed to find it any more efficacious than bismuth subnitrate.

*Antifebrin* is highly recommended by Bazilvitch; in my hands it has been of no especial value.

*Salol* has been employed by many writers; when used it must be weakened by the addition of twice the amount of either starch or talcum, otherwise it will prove very irritating.

*Sozoiodol* and *bismuth subgallate* each has its advocates.

*Mercury salicylate* is recommended and has been employed in the treatment of the initial lesion of syphilis; it should be diluted with some inert powder—say 1 part of the former to 4 parts of the latter.

*Sulfaminol* and *europhen* are the latest remedies employed in the treatment of specific ulcers. They are without odor, antiseptic, and cause no pain when applied to a sore. Recently I employed europhen in a limited number of cases of mixed chancre, with apparently excellent results; my experience with the drug, however, is thus far too limited to enable me to express a positive opinion as to its merits.

None of these drugs has in my hands proved as reliable as iodoform; however, its odor, which cannot be readily disguised, renders its use objectionable in other than hospital cases.

*Chancre of the Meatus.*—When the chancre occurs at or just within the meatus, the part should be bathed frequently with warm water, and touched once a day with a solution of 20 grains (1.3) of silver nitrate to the ounce (30.) of water. The nitrate is changed into silver albuminate, which makes a coating over the sore, thus protecting it from the irritating effects of the acid of the urine. The lips of the meatus should be kept apart by means of a small tent of iodoform-gauze, or a piece of lint wet with black wash. When the sore is within the urethra an application of a weak solution of silver nitrate may be made to the ulcer with the aid of the endoscope; the affected part is then to be covered with a powder composed of equal parts of iodoform and boric acid. In many cases there will be much swelling of the glans; this is best combated by an application of lead-water and laudanum. A flaxseed-poultice, applied hot and changed every third hour, will afford great relief.

If there be much pain in passing water, the patient should be instructed to soak the penis before each act of micturition, for ten minutes, in a cupful of water as hot as can be borne without scalding the part.

If the ulcer shows a disposition to extend, a 6 per cent. solution of cocain should be applied for five minutes and then the surface touched lightly with either pure carbolic or nitric acid. It should then be poulticed until the slough is cast off and granulation sets in. After this, black wash or any unirritating dressing may be used.

In some cases a chancre at the meatus will on healing be followed by contraction so great as to cause obstruction of the orifice; when this complication occurs meatotomy should be performed, care being taken to restore the opening to its normal size and at the same time not to make it too large. After the operation the incision must be kept open by means of small pieces of gauze introduced into the meatus; a short bougie should be passed daily, smeared with an ointment composed of oleum eucalypti f℥j (4.), unguentum petrolei ℥j (32.) On removing the instrument some of the salve remains in the urethra and has a beneficial effect upon the wound. The treatment is to continue until the cut has healed. The use of the bougie not only keeps the margins of the incision through the cicatrix from closing, but hastens the absorption of the induration around the part.

*Extra-genital Chancre.*—Chancres situated upon portions of the body other than the penis—as the fingers, lips, breast, mouth, throat, or anus—should be treated on the general principles already laid down. If the lesion occur on the finger of an obstetrician or surgeon, it should be treated by excision, so as to lessen the danger of infection and dissemination. When situated on the lips, the ulcer should be touched with a weak solution of silver nitrate, and dressed with a small piece of cotton moistened with a 4 per cent. solution of mercury oleate, and kept in place by means of collodion. If the mouth or throat be affected, a solution of silver nitrate, or one of 10 grains (0.65) of copper sulphate to the ounce (30.) of water should be applied to the sore once daily; and an astringent gargle used—such as pyroligneous acid ʒj (4.), water fʒviij (240.). An excellent combination consists of potassium chlorate ʒij (8.), boric acid ʒj (4.), oil of gaultheria gtt. vj, water fʒvj (180.).—M.

The use of tobacco should be interdicted until the ulcer has healed.

The disappearance of the sore is hastened by constitutional treatment, but unless the chancre shows a tendency to extend, or to interfere with some important function, such as deglutition or micturition, it it well to await the appearance of secondary symptoms before administering mercury itself.

In very rare cases the ulcer will heal and the induration gradually disappear, only to slowly reappear. This need give rise to no anxiety. The patient should be directed to apply a little collodion or blue ointment to the part. When, however, the relapsing induration is extensive, the indication is that there will be severe and protracted constitutional symptoms.

As soon as the ulcer presents a healthy granulating surface, cleanliness, with only the mildest applications and dressings, so applied as to afford protection from friction and injury, is the treatment indicated. The cure is often retarded by the practitioner, who, in his anxiety to produce rapid cicatrization, over-treats the case. This point cannot be too emphatically insisted upon.

*Chancres in Women.*—Chancres in females occur most commonly on the labia majora, labia minora, fourchet and vestibule, and more rarely on the clitoris. They are not commonly found in the vagina. On the neck of the uterus they are by no means as rare as some authors claim. They are not more frequently observed in this situation owing to want of care in examination, and also because they are frequently mistaken for erosions.

The initial lesion of syphilis in women is often associated with vulvitis. The sore, unless large, indurated, and situated upon the labia, is likely to be overlooked, and very often the first intimation the woman has that she is suffering from the disease is the appearance of secondary symptoms.

The treatment should be conducted on the principles already set forth. Cleanliness is best ensured by using daily a vaginal douche consisting of 1 quart (1 liter) of warm water in which 2 drams (8.) of potassium chlorate have been dissolved. The sores should be gently touched with a weak solution of silver nitrate and dressed with black wash. The lips of the vulva should be kept apart by means of absorbent cotton. If there be much inflammation or edema a solution of lead acetate and laudanum must be applied. The

patient should be kept at rest as much as possible, and the bowels maintained in a soluble condition.

If the sore be situated on the clitoris, it is generally attended with much pain. This can be relieved by touching the ulcer gently with solid silver nitrate; afterward applying a powder composed of morphin sulphate 2 grains (0.13); boric acid 4 drams (16.).

When the chancre is situated on the neck of the uterus the douche should be used as already directed, and an application made through the speculum directly to the sore, using a solution of equal parts of tincture of belladonna and tincture of iodin. A tampon of cotton is then to be applied, medicated with a mixture composed of iodoform 2 drams (8.), balsam of Peru 1 dram (4.), vaselin 1 ounce (32.). This should be changed daily.

**Treatment of Complications of Chancre.**—The complications of chancre are edema of the penis, phagedena, gangrene, phimosis, and paraphimosis.

*Treatment of Edema.*—Edema is not a common complication of chancre. When it does occur the patient should be put to bed, and the bowels should be freely opened by means of a saline cathartic. Hot-water baths should be given, and lead-water and laudanum should be applied to the part. If the swelling or tension be very great, much relief will be experienced by evacuating the serum by means of numerous small punctures made with an aseptic tenotome or exploring-needle. After the fluid has escaped, the punctures may be closed by the application of a solution of iodoform and collodion. Great relief is often experienced from hot applications. A tendency to frequent and painful erections may be controlled by a full dose of potassium bromid and camphor, or by gr. $\frac{1}{100}$ (0.00065) of hyoscin hydrobromate given at bed-time.

*Treatment of Phagedena.*—Phagedena is one of the most serious complications of chancre that can arise; fortunately it is not frequent. The first indications of its appearance should be met with decided and prompt measures. The patient should be etherized and the sore thoroughly washed with a solution of 1 : 1000 mercuric chlorid, then carefully dried, so as to get rid of as much as possible of the secretion of the ulcer lodging in the nooks and crannies of the sore; then, by means of forceps and scissors the entire sloughing tissue, together with the margins of the chancre, should be cut away. After the hemorrhage has ceased, the wound must again be irrigated with the antiseptic solution, dried, and thoroughly cauterized with fuming nitric acid. The part should then be freely dusted with iodoform and an antiseptic poultice applied. This consists of a piece of antiseptic gauze saturated with a hot 1 : 1000 solution of corrosive sublimate, which is to be wrapped around the penis. The dressing must be covered with rubber dam, so that it may remain moist and retain its heat.

All indications are fulfilled by this treatment: it puts an end to the destruction of tissue by destroying the specific micro-organisms present, whilst the poultice relaxes the blood-vessels, promotes the migration of the white corpuscles, and diminishes the pain; it also assists in the casting off of the slough

and stimulates granulation. The application must not be continued beyond two or three days. The part should be dressed at least every third hour, and each time bathed in a warm 1 : 2000 solution of corrosive sublimate. As soon as a healthy granulating surface is presented, the lesion is to be managed in the same gentle manner as directed for the milder forms of chancre. The patient must be kept at perfect rest, on easily digested food, and the bowels should receive proper attention. When there is a good deal of febrile reaction, or when the patient is debilitated, 5 grains (0.32) of quinin, with 20 drops of tincture of ferric chlorid, should be administered three times daily.

As a rule, stimulants should not be employed, but this is a matter wherein the physician must exercise his judgment. In cases in which the patient is broken down in health, and the constitution is below par, milk-punch or egg-nog will be of great service. If there be much pain, morphin should be administered in quarter-grain (0.016) doses.

There is no question but that mercury exerts a decidedly beneficial influence on chancres that have a tendency to become destructive. Under such circumstances its administration is advised until the ulceration is under control and is in a healthy condition, when the drug should be withheld and the appearance of constitutional symptoms awaited before placing the patient on a systematic course of treatment. The use of specific remedies during the primary stage of syphilis will naturally modify and delay the appearance of the secondary symptoms.

*Treatment of Gangrene.*—One of the rarest complications of the initial lesion is gangrene. I have met with but one case in which this was present. It followed a chancre of the urethra in a young colored man who presented himself for treatment at the Genito-urinary Clinic of the Jefferson Medical College Hospital; the line of demarcation formed just back of the corona and amputation became necessary.

An attempt should be made to arrest the gangrenous process. Any constriction caused by phimosis or paraphimosis should be relieved by an operation, and pure carbolic acid applied to the sloughing tissue and the surrounding ulceration; the parts should then be dusted with iodoform and dressed with an antiseptic poultice, to which has been added a solution of potassium permanganate to destroy fetor. The dressings should be changed at least every third hour. Much benefit is often derived from the application of tincture of iodin; this usually produces a blister, which seems to relieve the congestion of the superficial vessels. An excellent remedy, frequently recommended, is a saturated solution of iron potassio-tartrate. Nature should be assisted in the attempt to separate the sloughs by cutting them away from time to time with a pair of scissors.

As soon as granulations begin to make their appearance, all heroic measures should be abandoned, and the surface of the ulcer dressed with any mild lotion or salve; strict attention being always paid to cleanliness.

The patient should be kept in bed and placed on good, easily digested food, given in small quantities, at short intervals. Iron, quinin, strychnin, and

arsenic are the remedies to be relied upon. If there be much pain, opiates should be employed. If the individual be weak or his digestion poor, or if he be in a septic condition, whisky or brandy should be freely administered. The condition of the bowels should not be neglected.

In cases in which the entire thickness of the penis is involved in the gangrenous process, amputation should be resorted to as soon as a line of demarcation has formed, so as to rid the patient of the sloughing mass and hasten his recovery by lessening the absorption of putrid matter, and in order that he may recover with as good a stump as possible.

*Treatment of Phimosis.*—When phimosis occurs as a complication of chancre, the main question to be decided is whether or not circumcision is necessary. If the ulcer is accessible it is to be treated on general principles. When the contraction is due to the sore being situated on the prepuce, circumcision does not become necessary, provided the ulcer shows no tendency to spread and it can be kept clean and is amenable to treatment. When cicatrization has taken place circumcision is often indicated so as to relieve phimosis due to the contraction of the scar.

If the ulcer is concealed by a long foreskin, and the opening in the prepuce is large enough to admit the nozzle of a syringe, circumcision can be delayed until the ulcer is healed, provided there is no evidence of great inflammation or destruction going on under the prepuce. The operation should be at once resorted to if the inflammation runs high or if the ulcer is spreading. I have performed circumcision in many cases in which phimosis was associated with chancre, and have never experienced other than good results, union always taking place without unusual inflammation. If the opening in the foreskin is so small that the concealed chancre cannot be properly attended to and the secretions from the sore are retained, the operation should be performed. The method recommended by some surgeons of splitting the dorsum of the prepuce and leaving "dog-ears," as the flaps are called, is not to be advised. Complete circumcision is preferable; the mucous membrane and the skin are to be brought together by means of interrupted catgut sutures, which need not be removed.

In cases in which the opening is large enough to render the chancre accessible to treatment, the affected part should be washed out every third hour with a warm solution of boric acid and water; five grains (0.32) of the former to an ounce (30.) of the latter. A cold evaporating lotion is then to be applied. If edema of the prepuce or swelling of the glans appear suddenly, relief should be afforded by circumcision. After the operation the chancre is to be treated in the usual manner.

*Treatment of Paraphimosis.*—Should paraphimosis supervene, efforts should be made, if the case be seen early, to replace the parts by the usual manipulation. If there be much edema, the serum should be evacuated by means of multiple punctures. If the parts have been constricted for some time, say for two or three days, this method of treatment is not to be pursued; the constricting bands should be freely divided, selecting the dorsum of the penis just

back of the corona as the seat of operation. A curved bistoury should be used, cutting from within outward. Until inflammatory reaction subsides, the best dressing consists of lead-water and laudanum. The chancre is then to be treated on general principles.

**Constitutional Treatment of Syphilis in the Primary Stage.**—The time that elapses between the appearance of a chancre and that of the secondary symptoms should be utilized by putting the patient in the best possible physical condition to withstand the outbreak of the disease. As syphilis induces a condition of hydremia, and as syphilitic patients are generally hypochondriacal and suffer from want of appetite and loss of flesh, every measure should be taken to improve the general condition. That the skin, which has to stand the brunt of the secondary attack, may be in the best possible state, the individual should be instructed to bathe at least three times during the week and preferably every day. He should have his teeth examined and put in order, and kept clean. He should retire early, and thus ensure a full night's rest. His food should be nutritious and easily digestible. His clothing should be changed to suit the weather and the season. He should take a due amount of exercise in the open air. He should not indulge in tobacco to excess. Stimulants are not contraindicated provided they are indulged in with moderation. Excesses in this direction are sure to be followed by serious results. When not engaged in business pursuits every effort should be made to occupy the mind with entertaining works, by attendance at the theater, and by pursuing other methods of harmless recreation.

To aid reconstructive metamorphosis a good tonic should be prescribed, such as:

℞ Strychninæ sulphatis, gr. ss (0.032);
Acidi arseniosi, gr. j (0.065);
Ferri sulphatis,
Quininæ sulphatis, *āā* ℈j (1.3).—M.
Ft. capsulas No. xx.
S. One three times daily.

℞ Strychninæ sulphatis, gr. j (0.065);
Ferri et quininæ citratis, ʒiij (12.);
Acidi phosphorici diluti, fʒss (15.);
Syrupi zingiberis, fʒiij (90.);
Aquæ, fʒvj (180.).—M.
S. Teaspoonful in water three times daily.

The placing of syphilitic patients on tonic treatment seems to produce a good mental effect, as they often labor under the belief that the disease is receiving specific treatment.

Authorities differ as to the propriety of administering mercury during the primary stage of the disease. It is decidedly better to await the advent of the secondary stage before beginning specific treatment, for it is absolutely impos-

sible to make an indubitable diagnosis without having observed the constitutional manifestations. We may, however, be well-nigh positive when the ulcer is typical, or if by confrontation the female from whom the disease was contracted is found to be syphilitic. I have many times been consulted by patients who had been placed upon mercurial treatment during what was supposed to be the primary stage of the disease, and who were uncertain whether they had suffered from syphilis or not—a very unfortunate position in which to be placed, especially if matrimony be contemplated. As a rule, the data are not sufficient upon which to venture a positive opinion; the secondary symptoms must be observed with great care before committing one's self in so important a matter.

The first question asked by the patient is, "How long will it be before I shall be cured?" It is obvious that this query cannot receive an intelligent reply unless the first manifestations have been allowed to appear naturally. For example, in a case in which the earliest indications consist of slight glandular involvement, with a sparse macular eruption and a few superficial ulcers about the mouth, the prognosis would obviously be different from one in which at the outset there is general well-marked glandular swelling, high syphilitic fever, and one or two widely spread eruptions in association with mucous patches and alopecia. It is often asserted that early mild symptoms are usually followed by severe forms of syphilis of the nervous system. This has not been my experience in cases that have been properly treated. I agree with those observers who believe that the best results are achieved when specific treatment is deferred until the secondary symptoms appear.

There is no doubt that the internal administration of mercury will hasten the cicatrization of the chancre. Specific treatment is therefore advised in the first stage of the affection, *if the sore shows a tendency to spread or to become phagedenic.* In some instances, as when the individual is married, it may be necessary to begin treatment at once, so that the initial lesion may be cured with the utmost rapidity, and also that the secondary symptoms may be delayed and rendered as mild as possible.

A married man who has contracted syphilis should abstain from sexual intercourse for at least two years; but even after that time has elapsed there is risk of transmitting infection.

The general enlargement of the lymphatic glands that usually occurs before the outbreak of the secondary symptoms does not call for special treatment, disappearing, as a rule, in from six weeks to a year after specific treatment has been instituted. Whilst this condition is always the forerunner of secondary symptoms, and hence makes the diagnosis almost certain, yet for reasons already given the administration of mercurials is not advised.

A suppurating bubo should be treated on general principles.

Pains in the bones, which are generally worse at night, unless unusually severe, do not call for any treatment; if, however, they are sufficiently annoying to keep the patient awake, a full dose of phenacetin or acetanilid administered at bed-time is all that will be needed. As soon as the patient is placed on constitutional treatment the pains will rapidly disappear.

Syphilitic fever is generally slight, and in many patients is not noticed. Should it, however, be decided, a saline cathartic should be given, with a full dose of either quinin or antipyrin. A good combination to counteract fever and relieve the osteocopic pains consists of quinin sulphate and acetanilid each 1 dram (4.), divided into twelve portions, of which one is to be given in capsule three times daily.

The diet should be carefully regulated.

**Treatment of Secondary Syphilis.**—Whilst the true cause of syphilis remains undiscovered, it is unquestionably a fact that mercury will neutralize the specific poison which causes the disease. It is still a mooted question whether the drug acts by destroying or by eliminating the poison. Some authorities claim that its action partakes of both destruction and elimination, for soon after its administration the metal can be detected in the saliva, perspiration, urine, and alvine evacuations. There can be little doubt that syphilis owes its origin to a specific microbe, and it is claimed by the believers in this theory that the mercury when disseminated throughout the system exerts a germicidal influence, destroying the causative organism or its products which give rise to the symptoms of the disease.

Clinically it has been demonstrated that mercury is useful in all stages of syphilis; and in a large percentage of cases it will be found to be curative, if intelligently administered in proper doses and for a sufficient length of time; hence it forms the basis of all the best plans of constitutional treatment. In using mercury care is to be taken to obtain all of its beneficial effects and at the same time avoid annoying complications. The experiments of Diday on forty-three cases of syphilis in which non-mercurial treatment was pursued would seem to demonstrate that mild forms of the disease manifest a tendency to self-limitation, a cure taking place in from eighteen months to two years. This method of treatment, together with the dangerous doctrine of the anti-mercurialists, under which is also included the dogma of syphilization (that is, inoculation with syphilitic matter), is fortunately little in vogue at the present time. There can be no question but that the judicious use of mercurials shortens the course of the disease, and increases the chances of cure—thus lessening the risk of development of the tertiary stage. It frequently happens that specialists have under their charge patients who, having suffered from secondary syphilis, emerge from a two years' course of mercurial treatment, together with proper hygienic management, in better general physical condition than they were before they contracted the disease.

Experience teaches that when grave forms of syphilis of the osseous and nervous systems have followed mild secondary symptoms they have occurred mostly in cases that have been neglected; or in those in which the practitioner in charge has been thrown off his guard by the innocent manifestations of the disease, and has unfortunately discontinued treatment too soon. In some instances the tertiary stage will follow when, from want of experience, the medical attendant has been afraid to administer mercury in sufficiently large doses and for a proper length of time.

Whenever a mild secondary outbreak is met with, one is justified in giving a favorable prognosis, provided a proper course of treatment is followed.

*Hygienic Treatment.*—In the treatment of syphilis one of the most important points to be insisted on is that the patient pay close attention to the laws of hygiene. He is to be properly instructed in his mode of living. His general physical condition should be carefully looked into. He is not to be overworked; plenty of rest is essential; he is to retire early and sleep as late in the morning as his vocation and circumstances will permit.

His food should be nourishing and easily digested and taken at fixed periods, not in haste, but well masticated. The digestive apparatus should receive special attention; if the individual is dyspeptic, his diet should be properly regulated, and such remedies given to assist digestion as may be indicated. Diarrhea should be promptly controlled, costiveness relieved, and the patient instructed to have a daily movement of the bowels at as nearly as possible a fixed time.

It is most essential that the skin should be kept in the best possible condition. With this end in view a bath, of comfortable temperature, should be taken daily, and when the lesions of the skin have disappeared, a Turkish bath every two or three weeks will be of benefit; care being taken not to remain too long in the hot-room.

The clothing should be adapted to the weather, and the patient should dress in accordance with variations in temperature; exposure to cold and wet should be avoided, to escape catarrhal inflammations of the mucous membranes that would necessitate the suspension for the time being of specific treatment. On damp, wet days the feet should be protected by india-rubber shoes; especially is this important if the patient is on a course of mercurial treatment. The teeth and gums should receive particular care. The teeth should be put in perfect order and a tooth-brush moistened with some slight astringent or cleansing agent, such as tincture of myrrh, should be used daily.

All excesses of any description should be rigidly abstained from. Alcoholic or malt liquors in moderation are often beneficial; in excess, they are suicidal. Tobacco, if not abused, is harmless, providing the patient has no lesions of the mouth or throat, when it acts as an irritant, and undoubtedly increases the ulceration and retards the cure.

A moderate amount of exercise, preferably in the open air, such as walking, rowing, tennis, bicycling, horseback-riding and the like should be advised. Weak patients and those of slight muscular development will be wonderfully benefited by light gymnastics for half an hour or so daily; followed by brisk shampooing with sweet-oil, and a warm shower-bath. If the gymnastics are irksome, indoor exercise should be substituted. Little benefit is derived when the exertion is made solely from a sense of duty. To obtain the best effects the mind should be pleasantly occupied.

Individuals of a nervous temperament should be encouraged by favorable prognostication as to the result; by making light of complications, by devising means to keep their minds agreeably engaged. A change of climate is

often beneficial when the patient is anemic, debilitated, or of a tuberculous diathesis.

Intercurrent affections are common. Probably the most prejudicial are gout and rheumatism. I recall many patients who whilst laboring under an attack of syphilis have suffered from typhoid fever, have convalesced and afterward passed through their specific trouble without untoward symptoms. The mercurial treatment should be prolonged to make good the time lost during the intercurrent illness. Malaria is a frequent complication, especially in the Southern States; but unless very severe and associated with anemia, it seems to have no injurious influence on the progress of the primary disease. The cases, however, should be carefully watched, and quinin, iron, and arsenic administered in conjunction with mercury.

Pneumonia, bronchitis, and tonsillitis are frequently contracted by patients suffering from syphilis. These diseases should be treated in the usual manner, specific treatment being suspended for the time being.

Mercury may be introduced into the system by the mouth, by hypodermic injection, by inunction, and by vaporization. The objects to be accomplished by these different modes of treatment are the employment of the smallest possible quantity of the medicine necessary to effect a cure; exactness of dosage; rapidity of action; permanency of effect together with simplicity and convenience of administration.

*Preparations of Mercury.—Mercurous Iodid; Mercury Protiodid.*—There are several preparations of mercury employed in the treatment of syphilis. Preference, however, is given to the protiodid, as it apparently has less tendency to accumulate in the system than other compounds, and consequently is more readily managed. It is not liable to produce sudden and severe ptyalism, with gastro-intestinal derangement.

*Mercury tannate* is next in value to the protiodid. It may often be employed when the last-named drug disagrees with the patient. It is easily assimilated and quickly eliminated, and may be given in large doses without fear of producing salivation. It is well borne by children, and may be administered in milk. It may be given in the form of powder in doses of gr. iss (0.097).

*Mercury with chalk* is best used in the treatment of syphilis in children. Many of these little patients seem to fatten on this preparation. It may also be employed as a substitute for the protiodid when the latter disagrees.

*Mercurous chlorid, calomel,* is not much used in the United States as a remedy in the routine treatment of syphilis. If long continued it gives rise to intestinal irritation; and it is liable to accumulate in the system and produce salivation.

*Mercuric chlorid, corrosive sublimate,* should be employed in conjunction with potassium iodid. This combination may be used to advantage in cases of so-called *syphilis hereditaria tarda,* and when a tonic is needed in conjunction with specific treatment. Mercuric chlorid should be employed with caution. It is an uncertain remedy, of little service in small doses and capable of doing much injury in larger quantities. It is one of the best preparations for hypodermic use.

*Massa hydrargyri, blue mass,* is not a very satisfactory form of mercury when a continuous course of treatment is needed, but it is valuable in combination with iron and quinin when these remedies are indicated.

*Mercuric iodid* may be used instead of the protiodid when the latter causes griping or diarrhea. It is, however, more likely to induce intestinal irritation than the green iodid. It combines very well with potassium iodid when it is necessary to use these remedies together.

The *carbolate, salicylate,* and *succinimid* are mercurial salts of minor importance. Each has its advocates, but none has, in the minds of the profession, supplanted the older standard preparations.

*Ipecacuanha.*—It is claimed by Curtis that ipecacuanha in small doses, combined with mercurial preparations, prevents unpleasant effects upon the mucous membranes.

*Tartar emetic* in doses of gr. $\frac{1}{16}$ (0.004), in conjunction with mercuric iodid, induces activity of the skin, and is recommended by many authorities. I have abandoned its use owing to its tendency to destroy the appetite, sometimes nauseating the patient, and producing general relaxation of the system.

*Opium* in combination with mercury is not advisable. In rare cases in which an idiosyncrasy exists, and the alimentary canal does not seem to be able to tolerate even very small doses of mercury, minute quantities of opium may be used, in the hope of establishing a condition of tolerance. When this result has been achieved the drug should be abandoned. Opium masks the effect of the mercury, so that more than a tonic dose may be administered. In addition, there is always the danger of the patient contracting the opium-habit. At the outset, while the physician is endeavoring to determine the susceptibility of the patient, the slight griping and looseness of the bowels, which are of frequent occurrence, may be relieved by small doses of paregoric.

Different authorities recommend different methods of giving mercury by the mouth. These may be designated symptomatic, continuous, systematic, modified systematic, and the treatment by interrupted courses.

Most writers agree that the best method of treating syphilis is by a course of mercury administered by the mouth for a period of two years, with short intermissions during which the remedy is to be employed either hypodermically or by inunction. The administration by the mouth is temporarily suspended on the assumption that the digestive tract becomes accustomed to the remedy, which is consequently in a great measure eliminated instead of being absorbed. The suspension of the drug gives much-needed rest to the gastro-intestinal tract. Other authorities, prominent among whom is Taylor, contend that the continuous administration of mercury results in "toleration"—the drug losing its influence over the disease and ceasing to have any effect as a therapeutic agent. Administered in this manner it frequently gives rise to anemia, debility, and gastro-intestinal catarrh.

Mild cases presenting a light macular eruption, with a few mucous patches, reappearing from time to time, do well when placed on a course of mercury by the mouth continued for twenty-four months. The patient should then be

placed on potassium iodid, in 10-grain (0.65) doses, for four months. Should a year elapse without signs of activity of the disease, the chances are that there will be no further trouble.

In cases only met with once or twice in a long and extensive practice, in which there is an idiosyncrasy to the administration of mercury by the mouth, dependence must be placed upon hypodermic injections and on inunctions. In one case of this kind, in the course of treatment extending over two years, 249 injections were administered. From time to time inunctions were alternated. Four years have passed since treatment was discontinued. The patient is in perfect health; has had no sign of return of the disease; has been married for two years, and his wife is perfectly healthy, but has borne no children.

The *symptomatic*, "modified," or "expectant" treatment consists in the administration of a mercurial for a lengthened period after the first constitutional symptoms have disappeared—say from four to six months. Treatment is then omitted until a fresh outbreak shows that the disease is again active, when the remedies are again to be resumed until the symptoms are subdued. As a general rule, when the disease continues to reappear it is syphilis of a later stage, until finally in the majority of cases the tertiary stage is reached.

The records of the Jefferson Medical College Hospital and of the Philadelphia Hospital exhibit numerous cases in which specific treatment has been pursued only whilst the syphilitic symptoms continued; the individuals returning to their lives of hard labor, dissipation, and bad hygienic surroundings, ultimately reappearing at the hospitals suffering with various forms of tertiary syphilis, large numbers becoming hopeless invalids. This method of treatment, therefore, may be regarded as dangerous and unsatisfactory. Its employment is not recommended.

*Interrupted Method.*—This method of treatment was first suggested by Fournier, who taught that the mercurial should be given unintermittingly for two months; then discontinued regardless of whether there were any symptoms present or not; at the end of two weeks the remedy was resumed and continued for two months, again discontinued, and so on for the space of two years.

The interrupted method as modified by the late Professor S. W. Gross will now be described.

In treating a patient interruptedly the first thing to do is to ascertain what amount of the remedy will be borne, and also what dose can be taken with safety, so as to control the symptoms, eradicate the disease, and if possible place the patient at the end of two years in as fair bodily condition as he was when the malady was contracted.

Mercurous iodid administered in doses of gr. $\frac{1}{5}$ (0.013) in the form of pill should be given three times daily; at first one pill should be taken from twenty minutes to half an hour after each meal. At the expiration of two days a pill is to be added to the mid-day dose. If this is well borne, an additional pill is to be given in the evening, making one after breakfast, two after luncheon, and two after dinner, so that within the twenty-four hours one grain (0.065) of the drug is taken. At the termination of twenty-four hours another

pill is to be added. Should no trouble arise, an additional fifth of a grain may be given at the expiration of another twenty-four hours. This course is to be pursued until slight tenderness of the gums or diarrhea indicates that the limit of tolerance has been reached. This will usually be found to be the case by the time seven or eight pills are administered during the day. One pill at a time should then be dropped until the unpleasant symptoms subside. In this way is ascertained the quantity that the patient can stand. Should the patient lose weight during the administration of the mercurial, the dose should be further reduced.

Watchful care should be exercised to prevent the occurrence of ptyalism. The best and safest rule is that laid down by White, who claims that the teeth, mouth, and gums furnish the essential manifestations of approaching salivation. He calls attention to the fact that "one of the indications is the thickening of the saliva, which also becomes increased in quantity, which condition is associated with sponginess or tumefaction of the gums, and finally a feeling of lengthening of the teeth and a sensation of slight tenderness when they are brought sharply together." These manifestations, especially if associated with griping, active diarrhea, and loss of weight, should warn the physician that the patient is taking too large a dose of the medicine, which should be reduced until the troublesome symptoms subside.

After the susceptibility of the patient has been determined, he should be kept on the dose decided upon for a period of two months after all symptoms of the disease have disappeared. The drug should then be withheld for two weeks. In this manner, with alternate intermissions of two weeks and persistence in treatment for four months, the specific medication should be kept up for two years. At the end of this time the patient should be placed upon potassium iodid in 10-grain (0.65) doses, three times daily, for a period of four months. He should then remain under observation without treatment for one year. Should no symptoms of the disease now appear, the patient may be considered cured. If, on the other hand, symptoms of syphilis appear during the course of treatment, the dose of the mercurial should be increased, or its administration by the mouth be suspended, and hypodermic injections of corrosive sublimate or inunctions of mercury resorted to; the first-named method is preferable.

During the period occupied by the treatment the patient should use a mouth-wash composed of potassium chlorate ʒiij (12.), glycerin fʒj (30.), water fʒiv (120.). This will have a cleansing effect and will serve to keep the mucous membrane in good condition.

Should the patient have a relapse during the year succeeding the treatment laid down, the full dose of mercury should be again administered for at least six months. At the end of this time it will be well to inject 0.1 c.cm. (gr. ss) of gray oil hypodermically, at intervals of a week, for six weeks. Then potassium iodid should be prescribed in doses of gr. x (0.65) three times daily for four months. This treatment will usually prevent further trouble.

It is rare for mild forms of syphilis, when treated systematically for a lengthened period, to reach the tertiary stage; yet such cases are met with.

In severe cases, that is, when the patient has had high fever, severe pains in the bones, general adenitis, with the appearance of several different forms of eruption at the same time, such as widespread roseola, vesicular or crustaceous eruptions, mucous patches, or alopecia, indicating that the individual has absorbed a large amount of syphilitic poison, a continuous mercurial course of treatment running through two and a half years is to be followed; to which should be added small doses of potassium iodid during the last six months of the time. For reasons already given the mercury should not be administered by the mouth for the whole of this period. In the intermissions hypodermic medication or inunctions may be substituted. The appearance of crustaceous or pustular eruptions, especially on the face, at any time during the secondary period, is an indication that potassium iodid should be given in doses of gr. x (0.65) in conjunction with the mercury. The iodid has a marked influence in causing a rapid disappearance of these troublesome symptoms. As soon as the eruptions have been dissipated the iodid should be discontinued, and the mercury resumed alone.

The interrupted method is looked upon as unsafe, and is not recommended; other modes of treatment about to be described seem to fulfil more nearly the indications and at the same time offer to the patient a better chance of ultimate recovery.

The *continuous method* of treatment is strongly recommended by Professor Keyes of the Bellevue Medical College Hospital, and is called by him "the tonic method of treating syphilis." It is much in vogue throughout the United States. It consists in the employment of some preparation of mercury, such as blue mass, corrosive sublimate, gray powder, or the green iodid—preferably the last-named, as it is more thoroughly under the control of the practitioner; it is not as likely to accumulate in the system as other mercurials, and it is presumed that some benefit is derived from the absorption of the iodin held in combination. Whatever the preparation determined upon, it is to be administered in the recognized fractional doses. The bichlorid is given in doses of one-tenth of a grain (0.0065); blue mass, one grain (0.065); protiodid, one-fifth of a grain (0.013), and gray powder, two grains (0.13).

If the protiodid be selected, a single granule of one-fifth of a grain is to be given three times daily, after meals, for three successive days; after this the mid-day dose is increased by the addition of one granule; so that for the succeeding three days the patient takes four granules daily; it is then increased by an additional granule after the evening meal and so on, another granule being administered until the characteristic effects of the mercury, such as griping and diarrhea, are produced. Keyes says: "Occasional pain I pay no attention to; free movements of the bowels I do not regard if they are not watery; mild colicky diarrhea is what I wait for, and when this comes I write down the number of pills required to produce it, and name this number the *full dose.*" The patient continues on the full dose for a short time, when it is reduced to one-half in quantity, and this is known as the "*tonic dose.*" Keyes states that frequently one-third the full dose will keep the syphilitic symptoms moderately in check.

When the quantity of mercury that can be tolerated has been ascertained and the amount established to meet the especial idiosyncrasy of the case, then any unpleasant symptoms may be controlled by the administration of opium in half-grain (0.032) doses.

Keyes states that, in his opinion, if a patient can tolerate but two-fifths of a grain of the protiodid within the twenty-four hours, it is not a proper case for the use of that particular preparation. A full dose, however, is to be employed whenever a fresh outbreak occurs or a new emergency presents itself. When corrosive sublimate or gray powder is employed, irritation of the mucous membrane of the mouth and gums indicates that the full effect of the drug has been produced.

If the symptoms of the disease are not active, and if they are controlled by the tonic dose, it should be administered continuously for two years. Should active symptoms present themselves, three-quarters of the full dose should be given, combined with a small modicum of opium if griping pains and looseness of the bowels render it necessary.

If, in spite of this treatment, an outbreak should occur, internal remedies should be suspended and mercury administered by inunction, fumigation, or hypodermically. Any of these methods may be employed at the outset if the symptoms are urgent, or if for any reason it is desirable to bring the patient under the influence of mercury without delay.

I am in the habit of employing the continuous method of treatment in cases of mild secondary syphilis which have a tendency to run an uninterrupted course, and which exhibit an occasional proneness toward activity by the appearance of mucous patches in the mouth; but should the early symptoms be grave and point to severe poisoning of the system, or should they not yield promptly to the continuous plan of treatment, but exhibit a liability to relapse, then recourse is to be had to the modified systematic method to be hereafter described.

The *systematic method* is the treatment employed by the distinguished authority Professor J. William White, and his suggestions are followed by many of the leading practitioners throughout the United States.

The period from the appearance of the initial lesion until the development of the constitutional symptoms is utilized by placing the patient in the best possible physical condition to endure the outbreak of the secondary stage. The individual is placed under the charge of a dentist and the teeth put in perfect order; the urine is examined and its condition determined; the gastro-intestinal tract and the digestion are regulated; if indicated, a proper tonic treatment is ordered, and a proper hygienic mode of life is prescribed.

On the appearance of constitutional symptoms, mercury in one of its various forms is administered internally. Preference is given to the protiodid in half-grain (0.032) doses, three times daily, to be increased by an additional dose every day until the susceptibility of the patient to the remedy is determined. The condition of the mouth is to be taken as the guide. The colicky diarrhea indicates the condition of the mucous membrane of the intestinal tract. Hence

if the diarrhea is troublesome the green iodid is abandoned, and some other preparation, such as mercury with chalk, in half-grain (0.032) doses, is to be substituted; the quantity to be increased daily by half-grain doses, as recommended with the iodid, until the desired effect is produced.

Should this remedy not agree with the patient, corrosive sublimate in one-tenth grain (0.0065) doses is to be substituted. If gastro-intestinal irritation be produced by these remedies, they must be temporarily abandoned and mercury by inunction substituted. It is believed to be not advisable to give opium in conjunction with the mercury.

Inunctions should be employed only in rare instances and when mercury administered internally proves irritating to the mucous membrane of the intestines.

Paregoric is recommended as the most advisable remedy wherewith to check diarrhea; it should, however, be discontinued as soon as the effect of the mercurial has been reached, which is determined by the saliva becoming thick, glairy, increased in quantity, with tumid and tender gums. When this condition supervenes, the mercury is to be reduced one-fourth and later one-half in quantity. If the ptyalism continue, the remedy is to be still further reduced.

The proper dose having been ascertained, the mercurial is to be administered for three months; then stopped, and inunctions substituted, which are to be employed for two weeks, when the mercurial is to be again given in the ascertained dose. This method of stopping the internal use of the mercurial every three months, and then applying blue ointment by inunction for two weeks, is to be continued for the space of two years, at the end of which time the patient is put on the use of potassium iodid for six months.

If whilst under treatment new symptoms of the disease manifest themselves, the remedy is to be administered in full doses until slight ptyalism is produced, when it should be again diminished. If the symptoms prove rebellious to full doses and amendment does not take place, inunctions may be additionally employed; or the internal exhibition may be suspended and inunctions alone employed. Should this method fail, hypodermic medication must be resorted to.

There is no question that the systematic method is one of the surest and safest modes of treating syphilis known to the profession; the use, however, of inunctions at the end of every third month is objectionable—the objections being the necessity for employing an attendant; the uncleanliness of the procedure; the time required for the proper performance of the task; the fact that many neglect or refuse to resort to the prescribed method, and that many persons who have thin and delicate skins are frequently affected with eczema as a consequence.

I have therefore somewhat changed the systematic method, and after an extended experience feel warranted in recommending a plan that I have named the "modified systematic method."

*Modified Systematic Plan.*—When the patient's susceptibility to mercury has been ascertained in the manner already described he is placed upon the

determined dose, to which potassium iodid is added if ulcerous lesions of the skin be present.

The mercury is given for four months, at the end of which time corrosive sublimate in doses of gr. $\frac{1}{6}$ (0.011) is given daily hypodermically for two weeks. Should the patient object to this treatment—and he rarely does—inunctions should be employed. At the end of a fortnight mercury is resumed by the mouth, and continued for four months, when it is again withheld, and hypodermic medication or inunctions resorted to. The treatment is thus continued for a period of two years. After this the patient should be placed on a mixed treatment consisting of potassium iodid and corrosive sublimate for four months, when hypodermic injections of gray oil are to be administered once a week for six weeks. Then the patient is to be put on potassium iodid, which is continued for four months longer. If a patient treated in this manner goes a year without further manifestations it is probable that he will have no further trouble, but it is advisable in severe forms of the disease that every year for a fixed period he shall undergo a course of mercurial treatment for at least two months; this can do no harm and will render it wellnigh certain that no further trouble will arise. Hypodermic medication is more applicable to dispensary patients than are inunctions. Some patients are averse to either method being pursued. In such cases the stomach must, of course, be relied upon.

*Tonic and Specific Method.*—When the patient is weak, anemic, or tuberculous, a full mercurial course cannot always be carried out, and it is well to begin treatment with hypodermic injections of corrosive sublimate, to be continued for one month, using the stomach as a medium for supplying the most easily digested pabulum that can be procured, and at the same time administering such tonics as iron, quinin, nux vomica, cod-liver oil, or compound sirup of the hypophosphites. Those who suffer from impaired digestion should be allowed a certain amount of stimulants; these are best given in the form of milk-punch, egg-nog, egg-flip, or good Burgundy. If, together with want of appetite, there is loss of sleep, beer or ale at luncheon or at bed-time is to be recommended.

At the end of thirty days the injections should be discontinued and the following prescription ordered:

℞ Pil. hydrargyri,
Quininæ sulphatis, āā ℈j (1.3);
Ferri sulphatis, ℈ij (2.6).—M.
Divide in pilulas No. xx.
S. Take one three times daily.

If necessary, a minimum dose of opium may be added to each pill.

If the general condition of the patient has improved, a full dose of mercurous iodid in pill-form, given before meals, may be substituted for the hypodermic injection, and a tonic such as the following may be directed to be taken after eating:

℞ Tinct. nucis vomicæ, fʒij (8.);
Syrup. ferri iodidi, fʒiv (15.);
Olei morrhuæ, fʒxij (45.);
Olei menthæ piper., gtt. vj;
Syrupi simplicis, q. s. ft. fʒvj (180.).—M.
S. A tablespoonful in water.

An excellent combination of tonic and specific treatment consists of:

℞ Hydrargyri chloridi corrosivi, gr. j (0.065);
Tincturæ ferri chloridi, fʒj (30.).—M.
S. Twenty-five drops in water three times daily after meals.

If the patient loses weight and strength under the exhibition of mercury, its administration should be suspended, and the iodids and such remedies prescribed as tend to produce constructive metamorphosis. If necessary, a change of climate should be recommended.

If mercury is not well enough borne by the stomach, and the condition of the patient will not admit of its administration hypodermically, it should be given by inunction. In any event constitutional treatment in some form should be persisted in, interruptedly or continuously as the medical attendant may deem best, for at least two years. In this class of cases iodids often do harm, and the physician must determine, in each individual instance, whether or not they can be employed with benefit.

The prognosis in these debilitated, broken-down cases is not favorable, as may be readily inferred.

*Treatment of Malignant Syphilis.*—The so-called malignant form of the disease (fortunately, at the present time, rare) attacks by preference the weak and cachectic, and is often not only uninfluenced by specific treatment, but in some instances seems to be aggravated by it. In this form of the disease the best results are obtained from hypodermic medication alternated with inunctions. Of course the patient must have the best possible hygienic surroundings, together with good food and tonics. The iodids often serve a useful purpose and should be tried. The outlook is gloomy and the prognosis grave.

*Hypodermic Method of Medication.*—Hypodermic medication, as a method of routine practice, has not proved successful in my hands. Relapses have occurred in a large number of cases, and continuous treatment has been rendered necessary. The hypodermic method is of undoubted value when the lesions are situated upon the face and a speedy impression is desirable, and also when some important structure, as the iris, is attacked. Under such circumstances the results are almost magic. When the eruptions are of the papular form, the effect is not so rapid, but the lesions are more quickly influenced by this than by any other mode of treatment, as is likewise the case with those forms of eruption that are rebellious to other methods.

The hypodermic administration of mercury may be substituted for administration by the mouth in a modified systematic course of treatment. Thus given, the remedy acts more efficiently, and is usually more agreeable to the

patient, than when introduced into the system by inunction. The hypodermic method is used with advantage when the patient is a married man and time is an object. In cases of relapsing syphilis, when other methods have failed, subcutaneous injections of mercury have completely controlled the outbreak. This method of treatment will often yield satisfactory results in cases of syphilitic involvement of the nervous system, such as gumma of the brain or spinal cord, locomotor ataxy, and in some forms of syphilitic insanity.

Both the soluble and insoluble salts of mercury are employed for hypodermic injection. Of the former, corrosive sublimate is preferred in quantities ranging from gr. $\frac{1}{12}$ to gr. $\frac{1}{4}$ (0.0054–0.016); of the latter, only the gray oil is recommended. After a fair trial with the insoluble salts, with the exception of the last-mentioned preparation, I find that they give rise to pain, callosities, stomatitis, and ulceration of the gums. The soluble salts of mercury usually employed for hypodermic medication are the bichlorid, succinimid, oxycyanid, carbolate, formamid, benzoate, alaninate, mercuric albuminate, peptonate, and mercury asparagin.

Calomel, an insoluble salt, is largely employed by the profession for hypodermic medication in doses of from half a grain to 3 grains (0.032–0.19). Its use is always followed by painful callosities and frequently by abscesses; unexpected ptyalism is likewise prone to occur. The employment of this preparation is therefore not recommended.

The yellow oxid, black oxid, cinnabar, and metallic mercury have all been used hypodermically, but are as objectionable as calomel.

Of the insoluble salts, the gray oil is the only one to be recommended; this preparation produces callosities, but in no instance under my observation has it given rise to ptyalism or abscesses, and it has the merit of rapidly ameliorating the symptoms of the disease.

It is best to make the injections in successive intercostal spaces in the interscapular region, keeping about two inches from the vertebral column. To ensure the ready introduction of the fluid the patient should strip to the waist and sit on a chair. At the point where the injection is to be made the skin is picked up between the thumb and index-finger; the needle is pushed through into the fascia covering the muscles, and the solution injected into the cellular tissue. This manipulation is to be repeated daily, care being taken to watch the state of the gums, the quantity and character of the saliva, and for any manifestation of gastro-intestinal trouble.

The usual amount of mercuric chlorid, dissolved in water, which is to be injected is gr. $\frac{1}{4}$ (0.016), but if the patient has already been subjected to a course of mercurial treatment the amount should not exceed gr. $\frac{1}{6}$ (0.011).

The injections are to be continued until eighteen or twenty have been given, when, in most instances, gingivitis will have made its appearance. In such an event the frequency of injection should be reduced, so that one is given every second, third, or fourth day, according to the condition of the mouth. The symptoms named gradually subside as a rule. Injections are administered in the manner described until thirty have been given, when the patient is to be

placed upon potassium iodid, in doses of from 5 to 10 grains (0.32–0.65) three times daily, for a period of three months. All treatment is then discontinued. Should a relapse take place, and this is of frequent occurrence, similar treatment to that here laid down should be again instituted. Advocates of this method contend that upon its termination there will, in a large majority of cases, be no further symptoms, and that the patient is cured. This has not been my experience.

The administration of potassium iodid is based on the experiments of Vajda, in which he demonstrated that the remedy prevented the elimination of the mercury by the kidneys, thus keeping it stored for a longer period in the tissues of the body and diminishing the frequency of relapses.

Due regard must of course be paid to hygiene, diet, and the condition of the mouth and stomach. If necessary, tonics are to be administered.

Sixty cases of secondary syphilis were selected for treatment by hypodermic injection of mercurials, gr. $\frac{1}{4}$ (0.016) of corrosive sublimate being given at each injection, and each patient receiving thirty injections. Fifteen patients were inmates of the Philadelphia Hospital, thirty of the Jefferson Medical College Hospital, and fifteen were seen in private practice. The cases that were treated at the Philadelphia Hospital left the institution within a month, and could not be followed. Of those treated at the Jefferson Medical College Hospital, nine have not been heard from since their discharge; of the remaining twenty-one still under observation, eleven have returned and have been placed on other forms of treatment. Of the fifteen private cases, four have not been heard from since they were dismissed; of the eleven remaining cases, three have relapsed, and eight, up to the present time, remain in good health. The longest period that has elapsed since the discontinuance of treatment is six months. In most of the cases recurrence took place within from four to eight weeks after the injections were discontinued.

None of the patients made any especial complaint of pain caused by the injections; in no instance did an abscess form, and in none was there induration about the site of the injection. Several of the patients who returned were desirous of again submitting to the injections. In all the rapid disappearance of the symptoms was remarkable. In most cases constipation prevailed as a rule, and the employment of salines became necessary.

The use of metallic mercury in minute subdivision was first proposed by Professor Lang, who employed the combination known as 30 per cent. gray oil, and consisting of—

| | |
|---|---|
| Strong lanolin mercurial ointment, | 4.5 grains (0.29); |
| Oil of sweet almonds, | 5.5 grains (0.36).—M. |

Inject 0.2 c.cm. (℥iij) once a week.

Two injections each of 0.05 c.cm. (℥$\frac{3}{4}$) are to be made in different parts of the back. To carry out this treatment special syringes have to be constructed and carefully gauged. Before using the needle it should be thoroughly sterilized. The injections are to be repeated once a week for a period of six weeks.

During this time the patient should make use of an astringent mouth-wash, and be carefully and frequently examined for signs of ptyalism.

It is well to employ gray oil in cases of severe secondary syphilis when there is a tendency to a recurrence of the disease during the course of treatment, which should be concluded with six injections administered at intervals of a week. The patient should then be placed upon small doses of potassium iodid for a period of three months. This mode of treatment is more valuable in obstinate relapsing tertiary varieties of syphilis, and has proved more potent in my hands than any other method that has been employed. In five cases of this description thus treated, no symptom of the disease has reappeared within a period varying from eight months to one year. In cases of nerve-syphilis, hypodermic injection is far superior to inunction. In two cases of syphilitic locomotor ataxy under my care, the staggering gait, the girdle-pains, and the vertigo have entirely disappeared and there has been a progressive increase in weight and strength. Both patients, who were unable to walk when first placed under treatment, have returned to their occupations.

I have made over 1800 injections of gray oil. In each instance there was slight pain—not sufficient, however, to cause the patient to complain. In all, there was developed at the site of injection a hard lump persisting for from two weeks to two months. In no instance did an abscess form or any inflammatory symptoms develop. In one case there was slight ulceration and tenderness of the gums; in none was salivation induced.

As under other conditions, after the mercury has been suspended potassium iodid is to be given for a period of from three to four months.

After an extended experience with the use of mercury hypodermically I have come to the following conclusions:

1. This method of treatment will not abort the disease if used in the primary stage.

2. It should not be employed as a routine method of treatment.

3. The production of abscesses and of ptyalism by the employment of corrosive sublimate or of gray oil must be very rare. It has never been observed by me.

4. Injections of corrosive sublimate properly administered produce slight pain, but never callosities.

5. Gray oil gives rise to slight pain and always produces induration.

6. Gray oil employed in this manner is more dangerous than corrosive sublimate, and when administered the patient should always be carefully watched.

7. Corrosive sublimate and the 30 per cent. gray oil are the preparations to be preferred for hypodermic medication. In suitable cases when properly employed these remedies are among the strongest weapons possessed by the profession wherewith to fight the disease.

8. Hypodermic injections of corrosive sublimate are of undoubted value when the lesions appear on the face and a rapid impression is desired; likewise when some important structure, as the eye or brain, is attacked.

Mercurials may be employed hypodermically as a substitute for inunctions

in the systematic method of treatment. They can be used with advantage when time is an object. In cases of relapsing syphilis, in which other methods have failed, hypodermic injections have completely controlled the outbreak. They are frequently beneficial in those forms of eruption that have proved rebellious to other treatment. In syphilitic disease of the nervous system their use generally produces the most satisfactory results.

Under the conditions already laid down, this method of treatment is unhesitatingly recommended to the profession as the most reliable and active that can be employed.

*Treatment by Inunction.*—Some authorities prefer inunctions to any other mode of treatment. The mercury on being absorbed is changed into a soluble albuminate and comes directly into contact with the poison and destroys its virulence. It is eliminated by the emunctories, precisely as if received into the system through the mouth. Inunction is practised when a continuous "systematic" course of treatment is desirable and at the same time necessary rest to the alimentary canal is sought; or it may be resorted to when the patient is averse to the employment of hypodermic injections; or when, owing to idiosyncrasy, mercury cannot be taken by the mouth. Inunctions can be used advantageously in cases in which important structures are implicated, as the eye, brain, spinal cord; in cases of relapsing syphilis, and when the lesions are obstinate and will not yield to ordinary measures. They are frequently employed in cases of malignant syphilis, but find their greatest use in the treatment of syphilis in infants.

The objections to resorting to mercurial inunctions are the uncleanliness of the method, the trouble arising from its use, the time consumed in its execution, the production of severe attacks of eczema, especially in blonds with fair and delicate skins; furthermore, unless carefully watched it is likely to give rise to stomatitis.

Mercurial ointment, a mixture of equal parts of 20 per cent. mercury oleate and vaselin, and mercurial ointment reduced one-half in strength by the addition of vaselin, are the remedies usually relied upon for inunctions. Of these, mercurial ointment is by far the best. The quantity usually consumed for an adult is one dram (4.) each day. For a child the amount varies from a scruple (1.3) to a dram (4.). The applications should be continued for two or three weeks, signs of salivation being carefully looked for. Should dermatitis make its appearance the treatment should, as a rule, be discontinued, and the inflamed skin treated in the usual manner.

If possible, it is well to have the ointment rubbed into the skin by a masseur, who employs for the purpose a glass plate.

The most desirable parts of the body for the applications are the axillæ, the back, and the inner surfaces of the thighs, arms, and forearms. Each inunction should consume from twenty minutes to half an hour. When mercurial ointment alone is employed it is well to first anoint the skin with vaselin, in order to lessen the tendency to the production of eczema. The application is best made at bedtime, and care should be taken not to have the patient

wrapped, covered, or dressed too warmly, so as to avoid sweating, which interferes with absorption. Whilst undergoing treatment the patient should not bathe oftener than two or three times during the week, and it is not necessary for him to be confined to the house.

A favorite method of treatment pursued by the late Professor S. W. Gross was to direct the patient to bathe the feet in very hot water on going to bed; then to grease one foot thoroughly with half a dram (2.) of an ointment composed of mercury oleate and vaselin in equal parts; to put on a woollen stocking and wear it for twenty-four hours. On the following night the other foot was treated in the same way; thus alternating every night for a week. At the end of this time the feet were to be washed, and the treatment omitted for three days, when it was to be resumed and continued in the same manner until evidences of the specific effect of the mercury indicated that the treatment had been carried as far as was practicable.

Some authorities direct that patients undergoing treatment by inunction shall take a warm bath at bed-time, at the temperature of about 95° F. (35° C.), then retire to bed and have the mercurial ointment well rubbed into the body for the space of half an hour; a hot drink is now administered, and the patient is covered up thoroughly and allowed to perspire. In the morning he is permitted to rise and follow his usual avocations.

These patients must be carefully watched; not allowed to lose weight, nor to become debilitated. Their digestion must be looked after, and the condition of the mouth and gums kept under continued surveillance. The inunctions must be at once suspended should any unfavorable symptoms arise.

If, however, the patient stands the treatment well, the method here laid down should be continued for twenty or thirty nights. Sometimes it may be well to submit the individual to inunctions every other night, and again to omit them temporarily for some days and then return to the treatment. The physician is the best judge in these cases.

*Vaporization.*—Vaporization, or, as it is more commonly called, fumigation, is at present not much resorted to as a method of treating syphilis. It is of service, however, in cases that present obstinate chronic lesions of the skin, either local or general, or late secondary or tertiary lesions that will not yield to other treatment. Especially is it of benefit in the chronic scaly stage of early or late eruptions. It may be employed when mercury cannot be administered by the mouth and when specific treatment has been persisted in for a long period by the mouth and has apparently lost its influence. Under these conditions, however, most good is derived from using potassium iodid with tonics instead of mercury.

Vaporization should be employed at bed-time, the room being warmed, the patient stripped, seated on a cane-bottomed chair, and covered from neck to feet with a large blanket. Under the chair is placed the apparatus with the aid of which the mercury is to be volatilized and a supply of hot water vaporized. From 30 to 60 grains (2.–4.) of calomel are placed in the cup of the fumigator and a lighted lamp is placed beneath. The mercury is slowly volatilized

and with the aqueous vapor generated is deposited upon the surface of the body. The fumigation is continued for a period of from fifteen to twenty minutes. Without being dried the patient is then rolled in blankets and put to bed for the night. He should not be left alone during the process of fumigation, lest the exhaustion caused by the diaphoresis, or by the heat, induce sudden syncope and the patient fall from the chair and possibly set fire to the blanket.

Unless the patient be strong and robust, vaporization usually causes excessive debility, in consequence of the great flow of perspiration. When it is found that he is losing flesh and strength, the treatment should at once be suspended.

**Apparent Antagonism between Erysipelas and Syphilis.**—Neumann, Costella, and Molnar have shown that a marked antagonism exists between the bacillus of erysipelas and that of syphilis, and I have reported in the *Medical News* three cases that seem to support this view. As yet, no practical results have followed this observation. The subject invites further investigation.

**Treatment of Syphilis with Blood-serum.**—Quite recently the treatment of syphilis by means of injections of blood-serum has been brought to the notice of the profession. The principle of this method rests on the fact that micro-organisms produce not only substances that act injuriously upon the system in which they live, but also certain products, known as antitoxins, which have a destructive action on the microbes and render the soil unfavorable for their lodgment and development. Clinical observation seems to show that such immunifying substances may be carried either to the child through the mother's blood, or to the mother through the child infected by the father. It is well known that a healthy child born of a syphilitic mother cannot acquire the disease from any lesion the mother may have. Moreover, it has been observed that a syphilitic child born of an apparently healthy mother cannot infect her. This immunifying substance, whatever it may be, is found in the blood and tissues of infected persons, and in some instances, as for example in typhoid fever, has been shown to be eliminated by the kidneys.

Bonaduce holds that the children of syphilitic parents would escape infection more frequently but for the fact that hemorrhage or traumatism establishes a direct communication between the fetal and the maternal circulation; thus permitting inoculation of the healthy being with the specific microbe upon which syphilis depends.

For the purposes of treatment, the blood may be abstracted from the placenta of a syphilitic child, or from the blood of an individual at the height of the secondary stage of the disease, every care being taken to observe the most rigid aseptic precautions. Tommasoli has proposed making use of the serum derived from the blood of animals known to be exempt from syphilis, on the ground that the fluids of their bodies must contain some immunifying substance. He employs the lamb and the calf for this purpose. The serum of the dog has also been used.

The hypodermic needle, and the skin at the site of injection must be rendered thoroughly aseptic. A dram and a half (6.) of serum is injected subcutaneously every other day, preferably into the gluteal region on alternate sides.

As many as twelve injections should be used, although it is claimed that the disease will disappear after eight have been administered.

Pellizzari has expressed the hope that by the injection of blood-serum of syphilitics in the transitional period between the primary and the secondary stage of development, all secondary lesions may be averted.

Apparently successful results have been reported in several cases treated by this method. I have at this time a number of patients undergoing the treatment here laid down, but as yet it is too soon to determine the outcome.

Kollmann, following the clinical investigations made by Tommasoli, used for the purpose injections of the blood-serum of calves, sheep, rabbits, and dogs; he failed to benefit any of the cases in which the method was employed.

In severe cases of syphilis Menzies advocates the employment of thyroid extract in doses of from five to fifteen grains (0.32–1.) daily. He reports the cases of four patients who were unable to take mercurials, whom he treated in this manner. The results were remarkable.

The value of blood-serum and of thyroid extract in the treatment of syphilis is still *sub judice;* as yet we know absolutely nothing about the merit of these agents as remedies for the disease.

**Local Treatment of Skin-eruptions.**—When skin-eruptions assume the forms of erythematous, macular, or maculo-papular syphilids they need little treatment, beyond frequent bathing and attention to diet and to the condition of the digestive organs.

If the eruption appears on the face, and this is not common, the use of some cosmetic powder, or an application of 4 per cent. mercury oleate well rubbed into the spots at bed-time, will answer every purpose.

When acne presents itself, especially if on the face and hands, the contents of the papules, if pustular, must be evacuated by means of a sterilized needle. When the puncture is made the pus is to be squeezed out and the part rubbed with finely powdered alum, which causes the rapid drying up of the lesion. If the eruption be upon the hands, local vapor-baths are of great service. Under these conditions it is well to administer arsenic in combination with mercury.

The many varieties of papular syphilids are very obstinate in their course, yielding tardily to treatment and disappearing slowly. It is believed that the most rapidly beneficial results are obtained from hypodermic injections of mercuric chlorid in solution. Inunctions are next in value. Vapor-baths are useful in individuals of a robust constitution, when the papules are slow to disappear. Locally mercury oleate, or a combination of unguentum hydrargyri ammoniati ʒj (4.) and unguentum petrolei ʒj (32.) will hasten absorption.

In the papulo-squamous and in the pustular eruptions the crusts may be softened and removed by the application of cloths wrung out of hot water. When the crusts are removed the ulcer should be treated on general principles. An antiseptic dressing may be employed, or a salve containing the following ingredients will often be found of great service in relieving pain and hastening cicatrization :

℞ Unguenti hydrargyri nitratis, gr. xv (1.);
Balsami Peruvianæ, ʒj (4.);
Unguenti belladonnæ, ʒij (8.);
Unguenti iodoformi, q. s. ut ft. ℥j (32.).—M. ft. ung.

When the lesion is pustular or deeply ulcerated much good is derived from mercurial baths, as recommended by Finger. In all probability they have some restraining action on the bacillus of syphilis; they certainly have a distinct effect on pyogenic microbes, putting an end to suppuration and accelerating the cure. From half an ounce (16.) to an ounce (32.) of corrosive sublimate is dissolved in a cupful of water and added to the water of a bath of thirty gallons (120 liters). The bath should be kept at a temperature of from 78° (25.6° C.) to 80° F. (26.6° C.) by the addition of hot water from time to time. At first the patient remains in the bath about thirty minutes; gradually the time is increased to two hours.

If the lesion be situated on the arm or leg, that member alone is to be immersed. If the individual is suffering from papular or pustular syphilids of the hand, local fumigation is of great benefit. For this purpose the method recommended by Wells is to be followed. This consists in taking an ordinary hat-box, and making a hole in the top, through which the hand is to be inserted. Within the box is placed the mercurial and the apparatus necessary to carry on the fumigation. The addition of sulphur to the mercury will frequently be found beneficial. To remove the pigmentation left after a tubercular, papular, or pustular eruption, little can be done. In some instances the discoloration gradually fades and becomes whiter in color than the surrounding skin; in other cases it remains as dark-brown spots, throughout the patient's life; sometimes, however, though rarely, it entirely disappears. To remove the pigmentation, fumigation may often be used with benefit. Good results are sometimes also obtained from painting the part with collodion. Mercurial ointment may be tried.

Itching of the skin is a rare complication of syphilitic eruptions, yet some individuals suffer much from this cause. It usually occurs at night when the patient is in bed. It is relieved by sponging the surface with water and sodium bicarbonate, a couple of tablespoonfuls of the latter to a basinful of water. Should this fail, lime-water may be substituted for the soda. If the itching be severe, obstinate, and not relieved by specific treatment, arsenic should be administered in conjunction with the mercury.

*Treatment of Mucous Patches.*—Mucous patches are as a rule easily controlled. The patient should be directed to eschew all highly seasoned food, stimulants, and such diet as is likely to prove irritating to the sores. Tobacco in any form should be discontinued until the mouth is well. If the patches are superficial and not very numerous, they should be touched, at least once a day, with a solution of silver nitrate in the proportion of 30 grains (2.) to the ounce (30.) of water, and an astringent mouth-wash ordered, such as:

℞ Potassii chloratis, ʒiij (12.);
Acidi tannici, ϑij (2.6);
Olei gaultheriæ, gtt. vj;
Glycerini, fʒij (7.5);
Aquæ, q. s. ut ft. fʒvj (180.).—M.

If the patches prove obstinate, a solution of 1 part of acid mercuric nitrate to 12 parts of water should be employed as a substitute for the solution of silver nitrate. Application of a solution of chromic acid not stronger than ten grains (0.65) to the ounce (30.) of water is frequently of great benefit.

**Treatment of Syphilis of the Tongue and Throat.**—Tubercles of the tongue and excavated ulcers of the palate or tonsil should be treated by the application of solid silver nitrate, to be repeated if necessary. Hydrogen dioxid, in the form of spray, by means of an atomizer, repeated several times daily, makes a valuable local application. Tannic acid and glycerin will often be found useful. If there be great pain in deglutition a small piece of cotton moistened with 6 per cent. solution of cocain may be applied for a period of five minutes before eating.

If there be a tendency to the development of gangrene or phagedena, mercury is best administered hypodermically. Tonics, good diet, and stimulants are to be employed, and as soon as the patient is convalescent change of climate is to be recommended. Potassium iodid in conjunction with a mercurial will assist in arresting the progress of the disease.

Individuals who suffer from plaques on the tongue which show no tendency to heal will be benefited by the application of a solution of chromic acid 10 grains (0.65) in water 1 ounce (30.), used daily.

**Treatment of Lesions of the Vagina, Anus, Fingers, and Toes.**—Abrasions, patches, and fissures of the vagina or anus, or between the fingers or toes, may be treated on the same general principles that apply to these lesions occurring about the mouth and throat.

Absolute cleanliness is most essential. The parts must be kept dry by the use of any simple dusting-power; a very good combination being—

℞ Iodol, ʒj (4.);
Acidi borici, ʒiij (12.);
Lycopodii, ʒss (16.).—M.

**Treatment of Receding Gums.**—Sometimes the gums show a tendency to recede, there being, at the same time, no evidence of mercurialism. This condition may be removed by having the patient apply to the part twice a day some solution of chlorinated soda. A boric-acid mouth-wash, with tincture of myrrh or tannic acid, may also be used. The individual should be directed when using the tooth-brush not to move the brush laterally across the gums, but on the lower jaw to brush from below upward, and on the upper jaw from above downward, endeavoring thus to push the receding gums back to their proper position.

**Treatment of Condylomata.**—Condylomata yield readily to proper local

and constitutional treatment. Locally, absolute cleanliness, touching the part from time to time with a solution of silver nitrate, keeping the papule dry by means of a dusting-powder, protecting it by a covering of absorbent cotton, will be all that is necessary. The daily application of lactic acid will also be found very beneficial. The following combination will in some instances prove magic in its effects:

℞ Hydrargyri chloridi corrosivi, ʒss (2.);
Collodii, fʒss (15.).—M.

This should be painted over the part once a day. Generally after one or two applications the papule shrivels up and disappears.

When the growth is chronic, large, exuberant, and of long standing, especially when it occurs about the vulva, an operation may become necessary. The lesion may best be removed by means of the galvano-cautery. Should this not be expedient, the papule may be picked up with a pair of rat-toothed forceps and cut off, the wound being seared with the Paquelin cautery at black heat. The part is afterward to be dressed antiseptically. Some surgeons give preference to the Erichsen ligature, but its employment is not to be advised unless the means for applying the cautery are not accessible.

**Treatment of Alopecia.**—Alopecia may be so slight as to be hardly noticeable. It may be local or general. Whilst the hair that is dead cannot be prevented from falling out, yet by appropriate treatment the growth of new hair may be stimulated. Whether the loss of hair is due to the action of the syphilitic poison directly on the hair-bulbs, or whether the syphilitic virus causes a proliferation of the cells in the neighborhood of the part, with resulting pressure on the bulb, thus cutting off the circulation, is still an undecided question.

In order to hasten the growth of new hair, the use of a stimulating wash, such as the following, is recommended:

℞ Hydrargyri chloridi corrosivi, gr. vj (0.39);
Tincturæ cantharidis,
Tincturæ capsici, āā fʒiij (12.);
Spiritus ammonii aromatici, fʒvj (24.);
Spiritus rosmarini, fʒvj (180.);
Alcohol, q. s. ut ft. fʒvj (180.).—M.

The hair over the part to which the application is to be made is to be raised, and a sponge wet with this mixture rubbed well into the scalp; at the same time active friction of the part with the tips of the fingers is to be practised until it is thoroughly reddened. If the patient can afford the luxury, he should indulge in an egg-shampoo twice a week. He should be warned that the "dead hair" is certain to fall out, and that the new hair grows very slowly. On examining the scalp after a longer or shorter period, it will be found to be covered with a soft down, which in most instances will gradually grow into a natural suit of hair.

**Treatment of Onychia.**—For onychia little can be done beyond the proper internal treatment, and keeping the extremity of the finger or toe protected

from injury by means of proper dressings. As a rule, a rubber stall will answer the purpose until the old nail falls off and a new one takes its place. Ulcerations around the nail, due to syphilis, may be touched with a weak solution of silver nitrate, and afterward dressed with blue ointment. Lead nitrate dusted on the part will often induce a rapid cure.

**Treatment of Iritis.**—Diseases of the eye and ear are best referred to specialists. Iritis, however, is not an uncommon sequel of syphilis, and may arise when the services of an ophthalmic surgeon are not available. It is therefore thought proper to describe the treatment here. This is both local and constitutional. If the patient be seen early, and there is much pain, three or four leeches should be applied to the temple. The pupil should be kept dilated by means of instillations of a solution of two grains (0.13) of atropin to the ounce (30.) of water; one or two drops to be instilled every day, or every other day, according to the state of the pupil. As a rule the individual should remain in a darkened room and cloths wrung out of hot water kept constantly applied to the eye. If there is much congestion, the following wash may be used every three hours with advantage:

| | | |
|---|---|---|
| ℞ | Acidi borici, | ʒss (2.); |
| | Sodii chloridi, | gr. x (0.65); |
| | Aquæ destillatæ, | fʒiv (120.).—M. |

Bathe the eye with warm water, then drop into the conjunctival sac some of this mixture, first warmed. If adhesions form between the iris and the capsule of the lens, the frequency of the application and the strength of the solution of atropin must be increased. One drop of a solution containing 4 grains (0.26) of atropin to an ounce (30.) of water may be instilled every four hours; the patient at the same time being carefully watched for any appearance of the constitutional effects of the alkaloid. Should these present themselves the remedy must be immediately withheld. If, at the end of two days, the adhesions have not been broken up, a solution of 6 grains (0.39) of atropin to the ounce (30.) of water may be employed. This vigorous treatment will often succeed when milder measures fail.

The diet and the digestive tract should receive especial attention. Mercury should be pushed, care being taken not to induce salivation. The remedy should, however, be given in sufficient quantities to render the gums sensitive. Hypodermic medication is the most reliable and active treatment. Inunction follows next in potency. Potassium iodid in 10-grain (0.65) doses should always be administered with the mercury.

In iritis gummosa the patient should be rapidly brought under the influence of mercury and potassium iodid. If indicated, tonics should be employed at the same time. Should the iritis terminate in permanent adhesion, iridectomy is generally indicated, as synechiæ cause irritation and relapse of the inflammatory condition of the iris; in addition they may give rise to glaucoma.

During convalescence and for some time afterward the eyes should be protected from the influence of light by means of smoked-glass spectacles.

**Treatment of Tertiary Syphilis.**—In this stage of the disease all authorities agree that the iodids, including potassium iodid, ammonium iodid, sodium iodid, and iodoform, are more beneficial than the mercurials. Some authorities claim that the iodids give renewed activity to the mercury that has been introduced into the system during previous treatment. This explanation can hardly be correct, for Schuster has shown that within six months after a course of mercury has been discontinued, Nature eliminates the drug from the system; hence many patients who apply for treatment in the tertiary stage of the disease can have no trace of the mercury left in the economy; moreover, in those instances in which there has been no previous mercurial treatment the iodids exert a markedly beneficial influence. Again, it is asserted that the iodids actively modify nutrition, and cause a morphologic regeneration of the diseased tissues. Further, it is urged that the salts of iodin have a direct action on the specific infection, besides increasing the absorbing power by its vigorous action on the lymphatics. It is probable that the iodids, as well as the mercurials, exert a germicidal action on the microbe that causes syphilis. This action is far less marked with the former than with the latter; hence the proper use of mercury is much more valuable in the early stages of the disease.

The iodids will remove the tertiary lesions, but unless mercury be administered with them, or be given for some time after the iodids have been discontinued, the patient will in most instances suffer a relapse. Very frequently the quickest and most permanent results are to be obtained from the combination of mercury with some one of the iodids. This action is presumed to be due to the direct combined effect of the mercury and the iodid on the specific microbe or its products.

The administration of an iodid hinders the elimination of mercury by the kidney, so that a longer time is required for the process, the mercury remaining stored in the tissues and preventing relapses.

The exhibition of the iodids will not always relieve tertiary symptoms. I can recall many cases in which at first small and afterward large doses were administered to individuals affected with gumma, rupia, and adenitis without benefit, but as soon as gray oil was given hypodermically the rebellious symptoms rapidly disappeared. This accords with the experience of other observers; hence, if the iodids should not cause an amelioration of the symptoms, either mercury should be given in combination, or the iodids should be discontinued and some form of mercurial treatment employed.

A very important fact which must always be borne in mind, and which principally pertains to those who suffer from syphilis of long standing, and who have been saturated with antisyphilitic remedies administered for a long period, is that the system becomes so accustomed to these drugs that they lose their power to counteract the syphilitic processes. Especially does this apply to those who have, in addition to local lesions, a condition known as tertiary syphilitic cachexia. Many illustrations of the truth of this assertion are furnished by the venereal wards of the Philadelphia Hospital, which are filled with persons affected with chronic syphilis to whom specific remedies have

been administered for years, and upon whom antisyphilitic treatment has lost all effect.

The description of a single case will serve as an illustration: Sarah B., forty years old, had suffered with syphilis for fifteen years. She had been treated symptomatically. As soon as the lesion disappeared, treatment was discontinued until the disease made itself manifest again. I found the woman suffering with an extensive gumma of the leg, together with a general rupial eruption. Potassium iodid had been given, at first in minimum quantities and then gradually increased until the dose reached 260 grains (17.) daily, but without benefit. The patient was markedly cachectic, weak, anemic, and emaciated. Sleep was greatly interfered with by the intense and continuous pain in the leg. For this, morphin in large doses had been prescribed. Appetite was lost, and the patient presented a low grade of gastro-intestinal catarrh. The specific remedies were stopped, the diet properly regulated, and remedies directed that would improve and promote digestion. Later, tonics and stimulants were prescribed. The local lesions were kept clean and dressed with an appropriate soothing ointment. Gradually the patient began to improve in health and strength, and in a short time hypodermic medication was begun. Three months after the cessation of antisyphilitic treatment the woman was discharged from the hospital, cured.

As a rule, a course of potassium iodid should not be continued too long. If benefit is not derived from its use by the end of six or eight weeks, it is probable that the remedy will be of little or no service, and some other method of treatment must be adopted. In some cases of nervous syphilis it may be necessary to administer doses of the iodid for a longer period, but this should only be done when it seems absolutely necessary. When the iodids are given boldly and in enormous doses, such as of 60 grains (4.), three times daily, these should be administered for but a few days, and then gradually reduced. Care must be taken not to confound symptoms due to damage done to the nervous tissue, in consequence of the disease, with those of syphilis itself. Not uncommonly one is consulted about patients who have been under treatment for a length of time suffering from the effects of gumma of the brain, although the gumma had long disappeared, the resulting softening being uninfluenced by specific treatment, but rather injured thereby.

As has been pointed out, the iodids are indicated in the primary stage of syphilis if the initial lesion should become phagedenic.

Some authorities advise the employment of the iodids early in the second stage, so as to relieve headache and fever; but this is not recommended. Acetanilid, antipyrin, phenacetin, or quinin will usually afford prompt relief, whilst the use of the iodids delays the appearance of the secondary symptoms and mitigates their severity. For the papulo-squamous, tubercular, erosive, and ulcerative eruptions of tertiary syphilis the conjoined administration of the iodids and full doses of mercury is of great value, but the former should be discontinued and mercury alone administered as soon as the lesions have disappeared.

In malignant syphilis the iodids are strongly recommended. They should always be tried, but if found to disagree, or if the patient grows steadily worse,

they should be discontinued. They are always to be employed at the termination of either an interrupted or a continuous course of treatment, in combination with mercury, for an additional period of four months. This is especially indicated and useful in all tertiary forms of the disease.

Whether the iodids should be combined with mercury, or given separately, as well as the dose to be administered, must depend on the character of the lesions, their extent, and the portion of the body involved. If the patient is suffering from one of the skin-eruptions of late syphilis, it will be useful to give mercury with the iodids, adding iron if the individual be anemic. An excellent formula contains:

℞ Hydrargyri chloridi corrosivi, gr. j (0.065);
Potassii iodidi, ʒij (8.);
Syrupi ferri iodidi, fʒiv (15.);
Syrupi sarsaparillæ compositus, fʒiij (90.);
Aquæ, q. s. ut ft. fʒvj (180.).—M.
S. A tablespoonful three times daily.

Mercuric iodid may be substituted for the corrosive sublimate. Thus:

℞ Hydrargyri iodidi rubri, gr. iij (0.19);
Potassii iodidi, ʒij (8.);
Syrupi sarsaparillæ compositus, fʒiij (90.);
Aquæ, q. s. ut ft. fʒvj (180.).—M.
S. A tablespoonful in water three times daily.

When a tonic is indicated in conjunction with specific treatment good results have been obtained from the use of the following formula:

℞ Hydrargyri chloridi corrosivi, gr. j (0.065);
Tincturæ ferri chloridi, fʒij (7.5);
Liquoris arsenii chloridi, gtt. xlviij;
Potassii iodidi, ʒij (8.);
Syrupi zingiberis, fʒiij (90.);
Aquæ, q. s. ut ft. fʒvj (180.).—M.
S. A tablespoonful in water three times daily.

Patients who suffer from pain in the bones, constant headache, or syphilitic disease of the nervous system are by many practitioners given by preference potassium iodid in doses of from 20 to 60 grains (1.3–4.) three times daily, beginning with a small quantity and rapidly increasing the dose. For this purpose the so-called saturated solution, made up of equal parts of potassium iodid and water, and of which each minim represents a grain, is employed. This is to be given in a liberal quantity of water or in milk after meals. The general rule is to regulate the dose by the effect produced. If necessary, mercury may be given by the mouth, by hypodermic injection, by inunction, or by vaporization, in conjunction with the use of this "saturated" solution.

The iodid may be administered by enema, by baths, or hypodermically, but only when some emergency makes such recourse necessary. When an iodid is

given in unusually large quantities, it should be well diluted in order to protect the stomach from irritation and to hasten absorption. With this object in view, the individual should be instructed to drink freely of water shortly after the remedy is taken. To lessen the risk of iodism, Bartholow recommends the administration of 4 drops of Fowler's solution in conjunction with each dose of iodid. Better results have been obtained from the addition of 20 grains (1.3) of potassium nitrate or potassium bitartrate. S. W. Gross and Gray both state that quinin, given in doses of 3 grains (0.19), decreases the depression and assists in dispelling iodism, and my experience accords with this view.

Whilst tertiary syphilis can never be cured, the symptoms can in most cases be controlled and the patient lead a comfortable and useful life, provided he remain under proper supervision. He can, however, never be assured that there may not at any time be an outbreak, the disease invading even the very centers of life. It is well in these cases that every year at a fixed time a course of mixed treatment be pursued for at least six weeks. In this way a reasonable certainty is attained that the patient will remain free from any manifestation, provided the hygienic surroundings are healthful and a life of dissipation is eschewed.

The skin-eruptions should be treated locally in a manner similar to that detailed under the head of "Late Eruptions of the Secondary Period." Mixed treatment should be given, unless the destruction of tissue is rapid. In such an event the mercury should be withheld and the iodids pushed until the symptoms are under control, when the dose of the iodids should be diminished and the mercury resumed. When the lesions have healed, the iodids should be discontinued and full doses of mercury given for six months. In obstinate cases, and in those that do not respond to treatment, either hypodermic medication or inunction or vaporization should be employed.

Gumma of the skin or subcutaneous tissue should be treated with corrosive sublimate given hypodermically, while at the same time potassium iodid in doses of 20 grains (1.3) should be administered. Should the gumma show a tendency to extend and become destructive, the iodids should be given in large doses well diluted. The best local application under these conditions, when ulceration has not occurred, is blue ointment with gentle pressure made by means of a properly applied bandage. Under no circumstances should the tumor be lanced, even if it be on the point of ulcerating, as in most instances, with appropriate treatment, it will disappear without leaving any trace of its previous existence. Should, however, ulceration take place, an ill-looking, foul, undermined sore results, the bottom of which is covered with a dirty-white, tenacious slough, which in most cases requires to be removed by means of the scissors and curet before the ulcer will heal. In any event cicatrization takes place very slowly, and leaves the patient scarred for life. One of the best ointments that can be applied to hasten granulation consists of:

℞ Cerati resinæ comp., ℥ij (8.);
Unguenti iodoformi, ℥ij (8.);
Balsami Peruvianæ, ℥j (4.);
Unguenti petrolei, q. s. ut ft. ℥j (32.).—M.

The slough can be destroyed by the application of fuming nitric acid.

When the nervous system or the viscera are affected, the iodid must be given boldly, beginning with small doses, and rapidly increased, until as much as 180 grains (12.) are taken daily. This amount must not be continued for more than a few days, when the dose should be gradually reduced and mercury added to the treatment. Urgency of symptoms will decide the surgeon as to what method of administration is to be pursued.

Affections of the mucous membranes should be treated locally, in precisely the same manner as similar conditions during the secondary period. If the membranes be deeply ulcerated, the iodid should be given in larger doses. Ulceration of the soft palate calls for the administration of mercury hypodermically. Great care must be taken to keep the ulcer clean; for this purpose it should first be irrigated with Dobell's solution, then touched with a solution of silver nitrate and then by means of an atomizer sprayed with the following solution:

℞ Thymol, gr. iss (0.097);
Menthol,
Camphor, āā gr. v (0.32);
Liquid vaselin, fʒj (30.).—M.

Much benefit will often follow the touching of the ulcer with tincture of iodin, and the use as a gargle of the infusion of marshmallow.

Dactylitis is a gumma of a finger or toe, and should be treated in precisely the same manner as similar involvement of any other portion of the body. Mixed treatment is usually employed. Many syphilographers prefer to give the iodid in large doses. Before ulceration has supervened blue ointment makes one of the best dressings that can be employed. Should ulcers have made their appearance, antiseptic dressings are indicated. Deformity frequently follows this condition. Ulceration, caries, or necrosis may present itself, necessitating surgical intervention. Amputation may even become requisite; this, however, is rare.

When tertiary syphilis affects the tendons or their sheaths, aponeuroses, or bursæ, prolonged treatment is necessary. Locally, counter-irritation with tincture of iodin is indicated; subsequently the following ointment may be advantageously employed:

℞ Ichthyol, gr. viij (0.52);
Unguenti hydrargyri,
Unguenti belladonnæ, āā ʒiij (12.);
Unguenti petrolei, ʒij (8.).—M.

Syphilitic affections of the joints, provided erosion and ulceration of the cartilages do not take place, yield in most instances quickly and satisfactorily to mixed treatment. The local measures to be employed depend upon the condition of the part. In the acute stage of synovitis with effusion, counter-irritation by means of tincture of iodin or blisters of cantharides will often cause absorption of the fluid. Mercurial ointment, spread thickly on lint applied to the part and held in place by means of a firmly adjusted bandage, is usually

all that will be necessary. In cases in which absorption does not take place, the patient should be put to bed, the part rendered aseptic, and the joint aspirated, afterward placing the limb at rest by means of a plaster-of-Paris splint. When convalescent, the patient should wear a leather knee-cap for some time, so as to give the part proper support.

In chronic serpiginous ulceration around a joint it may be necessary to scrape the ulcer with a curet, afterward resorting to skin-grafting. In articular ostitis the constitutional treatment should be active; the joint should be kept at absolute rest and treated in the manner already detailed under the head of synovitis.

Mercury administered hypodermically is the best remedy for syphilitic periostitis. Potassium iodid should be given at the same time in doses of gr. xx (1.3) thrice daily. This condition requires prompt and vigorous treatment, lest caries or necrosis follow. The limb should be kept at rest, and in the acute stage blood should be extracted by the application of three or four leeches, or by means of multiple punctures made with a sterilized tenotome; afterward applying lead-water and laudanum. In the subacute condition a blister should be applied over the inflamed surface, and as soon as healing has taken place the part should be dressed with mercurial ointment. Should the skin become red, swollen, and tender, immediate benefit will be derived from subcutaneous division of the periosteum by means of a small, thoroughly sterilized tenotome.

For gumma of the osseous system mixed treatment is usually employed; the iodids, however, should always be pushed until the disease is under control. Before ulceration has taken place little need be done locally, beyond protecting the part from injury. Mercury oleate and mercurial ointment are often employed as local applications. Should ulceration occur, the use of the curet will be necessary, care being taken to dress the parts antiseptically. If caries or necrosis supervene, proper surgical procedures must be instituted. Should the gumma leave a ridge, induration, or exostosis, little can be done. The best results will follow the hypodermic use of gray oil. If the exostosis cause annoyance through pain or by interfering with the functions of any portion of the body, it should be cut down upon and chiselled away.

The treatment of late syphilis of the lymphatic or mammary glands is the same as that for tertiary syphilis involving any other portion of the economy, but it is advisable to administer the iodids in large doses for a short time. An ulcerating gumma of the mammary gland may call for operative intervention.

When syphilitic orchitis or gumma of the testicle appears, potassium iodid in large doses is generally recommended, sometimes with the addition of mercury. The best results are often obtained from full doses of mercury.

Hernia of the testicle, accompanied by a fungus of the superficial variety, will usually be found to cicatrize by placing the patient on mixed treatment, at the same time applying iodoform-ointment or mercurial ointment and strapping the testicle. If the fungosity is deeply seated, the growth should be touched with fuming nitric acid, dusted with a powder consisting of two parts of red mercuric oxid and one part of iodoform, and covered with a piece of lint, upon which has been spread mercurial ointment. The testicle is then to be strapped with adhe-

sive plaster. If the fungosity is pedunculated, it may be strangulated by means of an elastic ligature. After the slough has separated pressure should be applied. If the fungous growth be shaved off, it is usually rapidly reproduced. If all other methods of treatment fail, castration must be resorted to. The tone of the patient must be maintained by good food, tonics, fresh air, and such other measures as are usually resorted to to elevate the standard of health.

When the larynx is involved, treatment is often very effective in the early stages of the attack; later, tracheotomy may become necessary, and the patient be compelled to wear a tube permanently.

If the disease involves the lungs, the iodid should be given in large doses, together with mercury hypodermically or by inunction. Some authorities prefer mixed treatment, but, in any event, tonics such as cod-liver oil, compound sirup of the hypophosphites, arsenic, and iron are always indicated.

When the kidneys are involved and the case is seen early, mercury is to be relied upon. If the disease has reached a later stage, mixed treatment should be employed, with the iodids in full doses. The iodin eliminated by the kidneys may itself give rise to albuminuria; hence, if there is manifested no tendency toward improvement, and if the symptoms referable to the disease of the kidney increase rather than diminish, the iodids should be promptly discontinued.

It is a disputed point whether, in treating syphilis of the nervous system, iodids or mercurials are the more valuable. If the symptoms are urgent, both sets of remedies should be employed; the mercury being administered either hypodermically or by inunction, whilst the iodid is rapidly pushed and given in large doses as long as it is well borne by the stomach, or until there is marked improvement. Mixed treatment is then to be relied upon, in conjunction with suitable tonics.

Hemiplegia of a mild character usually responds readily to treatment. When, however, it is associated with impaired cerebration, mental hebetude, or stupidity, the outlook is grave. Much benefit may often be derived from moderate doses of the iodids continued for a long period. Electricity should be used with a view to preventing atrophy of the paralyzed muscles.

Epilepsy due to syphilis is in many cases curable. The best results are obtained from hypodermic injections of gray oil, at the same time employing the iodids in small doses, in conjunction with bromids if the spasms are frequent. This treatment should be continued for a protracted period.

Aphasia is by no means an uncommon manifestation of nervous syphilis. It usually yields to specific treatment; in fact, in many cases it is only by means of the therapeutic test that a differential diagnosis can be made.

Specific locomotor ataxy may be benefited by small doses of potassium iodid administered daily, together with hypodermic injections of gray oil.

Much good may follow specific treatment of insanity due to syphilis if the patient is placed in an asylum where he can receive special care and attention; but very often, even should the individual be benefited physically, the mind remains permanently weakened.

For coma or convulsions due to a specific cause, hypodermic injections of

corrosive sublimate in conjunction with potassium iodid in large doses constitute the best treatment.

Syphilis involving the spinal cord and special nerves is treated on the same principles as those governing analogous conditions of the brain.

In tertiary syphilitic cachexia, even if associated with specific lesions, antisyphilitic remedies, as a general rule, do harm. In most instances the drugs used have lost their influence. In this condition the digestion will be found to be poor, while the patients are emaciated, anemic, debilitated, depressed, and suffer from a low grade of intestinal catarrh. If they are so situated that they cannot receive the special care and attention that their cases demand the prognosis is most unfavorable.

It is of the utmost importance that every attention should be paid to the diet; at the outset the patients should be placed upon a plan of forced feeding with concentrated, nutritious, liquid aliment, in small quantities, frequently repeated. Milk is best, but, to prevent it from becoming distasteful, good, strong beef-soup may be alternated with it. A quart of the former and a pint of the latter during the twenty-four hours constitute the minimum quantity that should be given. Mellin's food, condensed milk, cocoa, racahout, koumiss, and beef-juice may be employed as substitutes for milk. Stimulants properly employed are of great service, promoting appetite, assisting digestion, and, by relieving depression, causing a feeling of contentment. The patient hould take a warm bath daily, followed by massage with vaselin and alcohol.

To assist digestion and promote constructive metamorphosis, a pill of the following composition may be given after each meal:

℞ Acidi arseniosi,
Strychninæ sulphatis,
Auri et sodii chloridi, āā gr. j (0.065);
Pepsini, gr. xl (2.6).
M. et divide in pilulas No. xx.

The gold and strychnin should be continued for a period of not less than six months. When the patient begins to improve in general health, iron may be added to the treatment. If after convalescence has set in the syphilitic lesions still persist, small amounts of corrosive sublimate should be administered hypodermically. Change of scene, a sea-voyage, or a visit to a mountain-resort will also be serviceable.

**Hereditary Syphilis.**—There are two methods of treating hereditary syphilis, the direct and the indirect. By the direct method the remedies are administered to the child either internally or locally.

The question naturally arises: How soon shall treatment be commenced with children born of syphilitic parents, but who present no symptoms? Some authorities claim that treatment should not be begun until symptoms manifest themselves, so that the physician may be enabled to judge of the severity of the disease by watching the first appearance of the lesions unmodified by treatment. It is further contended that it is not advisable to delay the appearance

of the symptoms by the use of mercurials. Other syphilographers contend that an apparently healthy infant of a syphilitic father need not be treated; if the mother was previously syphilitic, but has been free from all signs of disease during pregnancy, the child need not receive treatment; if the mother has recently been syphilitic, especially if she has presented symptoms of the disease during pregnancy, the child ought to be treated from birth, for in all probability it has latent syphilis which may break out with great violence at any moment.

Children born with manifestations of syphilis should immediately receive vigorous treatment. Fortunately, these little patients rarely long survive birth, generally dying of marasmus or some other kindred complication during the first year of life. The treatment is to be continued until all symptoms disappear; it is then intermitted, to be resumed from time to time if the disease makes itself manifest. This intermittent plan of treatment is considered safest, as it prevents the patient from becoming accustomed to the remedies used. It is best for a syphilitic child to undergo a proper course of treatment for a month or six weeks every year, until it reaches the age of puberty. Relapses are thus generally prevented, and the remedies are administered sufficiently long for the system to become accustomed to their effects and unsusceptible to their influence.

Mercurial inunction offers the most reliable and best plan of treatment for the infant, 2 drams (8.) of mercurial ointment being spread on a piece of muslin or lint, and applied to the child's body by means of a belly-band. This application should reach from the axilla to the groin, and be left in place for three days, when it should be removed and the child's body gently washed with soap and water, and the ointment reapplied. Children stand the exhibition of mercury well, and if the remedy be given in the manner here directed, very little trouble need be feared.

Mercury and chalk is a favorite remedy, and is much employed. It may be dropped upon the tongue in doses of from gr. $\frac{1}{12}$ to gr. ss (0.0054–0.032) thrice daily. It is, however, not as effective as inunctions, and frequently causes diarrhea.

Corrosive sublimate in doses of gr. $\frac{1}{150}$ (0.00043) is also recommended; it is, however, as a rule, too irritating to the intestinal canal to be employed for any length of time. Mercuric iodid is much used in conjunction with potassium iodid. Mercuric tannate is a very serviceable preparation, well borne by children, and may be administered in milk.

If there are marked tertiary symptoms, potassium iodid should be given in doses of from gr. ss to gr. j (0.032–0.065) in conjunction with mercury.

The following formula is highly recommended by Bumstead and Taylor:

| | | |
|---|---|---|
| ℞ | Hydrargyri iodidi rubri, | gr. j (0.065); |
| | Potassii iodidi, | ʒiv (16.); |
| | Syrupi sarsaparillæ comp., | |
| | Aquæ, | āā fʒij (60.).—M. |

A child one month old may be given five drops morning and evening, and the dose may be increased one drop every five days. If the child be over five years of age, a teaspoonful may be given thrice daily.

Corrosive-sublimate baths are frequently recommended for obstinate scaly eruptions that do not yield readily to treatment. They should be employed with great caution, as they are likely to be followed by excessive debility.

Hypodermic medication has its advocates, but is not generally recommended for infants either in England or in the United States.

In late hereditary syphilis—that is, when the disease appears at or about the time of puberty—mixed treatment, the doses being made proportionate to the age of the individual, usually yields the best results. The local lesions should be treated on the general principles already laid down.

The indirect method of treating hereditary syphilis consists in administering antisyphilitic remedies to the mother, the child imbibing them through the milk. Whilst there is no question that cases thus treated receive a certain amount of benefit, yet the procedure appears to be an unsatisfactory and unscientific mode of coping with the disease, as it is impossible to tell what amount gains entrance into the system, and it surely must be a minimum quantity. This course has not yielded me satisfactory results.

Infants and children require the most careful attention with regard to cleanliness and general hygiene. Tonics should be given when indicated. If the mother is unable to suckle her babe, artificial feeding becomes necessary. Gratifying results have been obtained by feeding the infant on "humanized" cow's milk; that is, by making the proportion of ingredients correspond as nearly as possible with that of those of mother's milk. For this purpose the milk is to be poured into a wide, shallow milk-pan, and allowed to stand for a period of three hours, when the upper third is skimmed off. To this is added the requisite amount of water, previously boiled and set aside to cool. When required for use the mixture should be warmed, sterilized, and sweetened. The proportions of milk, water, and sugar are furnished in the annexed table:

ARTIFICIAL LACTATION.

| Age. | Milk. | Water. | Sugar of Milk. |
|---|---|---|---|
| | | | To be added in the proportion of— |
| From 3 to 10 days old . . . . . | 1 pint. | $2\frac{1}{2}$ pints. | $2\frac{1}{3}$ ounces to 1 quart. |
| " 10 to 30 " . . . . . | " | $2\frac{1}{4}$ " | 2 " " |
| " 1 to 2 months old . . . . . | " | $2\frac{1}{5}$ " | $1\frac{7}{8}$ " " |
| " 2 to 3 " . . . . . | " | $1\frac{3}{4}$ " | $1\frac{3}{4}$ " " |
| " 3 to 4 " . . . . . | " | $1\frac{1}{2}$ " | $1\frac{3}{4}$ " " |
| " 4 to 5 " . . . . . | " | $1\frac{1}{4}$ " | $1\frac{5}{8}$ " " |
| " 5 to 6 " . . . . . | " | $\frac{4}{5}$ of a pint. | $1\frac{1}{2}$ " " |
| " 6 to 7 " . . . . . | " | $\frac{3}{4}$ " | $1\frac{3}{8}$ " " |
| " 7 to 9 " . . . . . | " | $\frac{3}{5}$ " | $1\frac{3}{8}$ " " |
| " 9 to 11 " . . . . . | " | $\frac{3}{4}$ " | $1\frac{1}{4}$ " " |
| " 11 to 14 " . . . . . | " | $\frac{5}{8}$ " | $1\frac{1}{4}$ " " |
| " 14 to 18 " . . . . . | " | $\frac{1}{2}$ " | 1 ounce " |

**Treatment After Marriage.**—Healthy women married to syphilitic men are threatened with two dangers—that of becoming infected, either directly or by conception, and that of contaminating their unborn children. The husband

should be fully informed of the evil that is likely to follow infection. He should be warned that the secondary period of the disease is the most dangerous, and be advised to beware of any erosion upon the penis or in the mouth, no matter how insignificant it may appear. Pregnancy should not be allowed to take place for at least four years after infection. The husband should at once be placed upon full specific treatment, to be continued for a period of two years and a half; and for the remaining year and a half he should be absolutely free from any manifestations of the disease.

Authorities differ as to the method to be pursued when the husband is syphilitic, and the wife, though pregnant, is apparently free from the disease. It is claimed by many that as the mother has escaped infection, there is a strong probability that the child will be healthy when born, and that nothing is to be gained by placing the mother upon constitutional treatment. It is, however, certainly the safer plan to place the mother under treatment, which will surely increase her chances of bringing forth a healthy infant.

It should be strongly insisted on that women who have syphilitic husbands, though they may never have manifested any symptoms of the disease, and yet have had one or more miscarriages, without any assignable cause, should receive full and prolonged specific treatment. When both husband and wife are infected specific treatment should be persisted in for two and one-half years, and every effort made to prevent pregnancy for at least four years after infection; that is, if no symptoms of syphilis have been observed after the constitutional treatment has been discontinued. Should pregnancy supervene, active treatment should be continued, as it is the only chance offered by which the child can escape the disease. During pregnancy vaginal douches of boric acid should be employed daily. Any lesion of the vulva should receive prompt attention in the manner already described. Condylomata should be treated as advised under the head of secondary syphilis. These growths should be carefully watched, for they are likely to increase with great rapidity and attain a large size, seriously interfering with parturition. Should they become chronic, increase in bulk, and refuse to yield to treatment, surgical interference will become necessary.

# DYSENTERY.

By W. W. JOHNSTON.

In the present state of knowledge no definite statement can be made as to what "dysentery" really is. At the moment this term includes all cases of colitis characterized by the discharge of blood and mucus from the bowel, but it is probable that it will not be long before the microscope will be able to differentiate such cases into groups due to the agency of different micro-organisms.

While the exact pathogenic significance of the *amœba coli* has not yet been determined, there is evidence enough to show that it is the probable cause of the dysentery of tropical countries and of one form of the endemic dysentery of temperate regions. In sporadic dysentery, the presence in the bowel of impacted fecal matter or toxic substances may possibly rarely act in causing dysentery, but it is probable that in this form also micro-organisms, not yet determined, are chiefly concerned in the development of the disease. This conclusion has a most important bearing upon all questions of treatment; we have to deal with an ulcerative colitis due to the presence of micro-organisms in the intestinal canal. At the present time the tendency of all treatment is toward the destruction of bacterial and ameboid life in the colon and rectum, and the empiric or purely symptomatic methods that have long held their own are ceasing to be employed, unless they conform to prevailing views of the pathology of the disease.

Clinically, dysentery may be divided into an acute and a chronic variety.

**The acute form** is characterized by fever, more or less prostration, tormina, tenesmus both rectal and vesical, and by small mucous and bloody stools. In many cases there is little or no tormina or tenesmus, while the stools may be large, thin, containing membranous flakes or shreds, small blood-clots or pus, and sometimes having a putrid odor. The gravity of the case is measured by the height of the fever, the strength of the heart-beat and the state of the circulation, the degree of prostration, and the frequency and character of the stools. When the stools are large, thin, putrid, containing membranous shreds and pus, a more serious lesion may be surmised than when the stools are small and consist of blood-stained mucus.

The treatment must take into account the situation of the lesion, the presence of ulcers, putrid decomposition in the bowel, with the resulting danger from auto-infection, and the known presence in some cases, with the probable presence in all, of a micro-organism in the intestines as the cause of the disease.

**Prophylactic Treatment.**—The measures that tend to diminish the liability of the individual to dysentery are the same as those that are conducive to good health in general. For communities, the complete drainage of the soil, the safe disposal of the excreta, and the securing of a pure water-supply are essential. The general sanitation of cities, and especially of public institutions in which many inmates are crowded together, contributes to the prevention of outbreaks. In times of epidemic influence great attention should be paid to public and individual hygiene, and it is then that the disinfection and proper disposal of the excreta and the securing of pure drinking-water must receive the closest attention. All drinking-water should be filtered and boiled, even if the source from which it is derived is above suspicion.

With the first appearance of the symptoms the patient should be put to bed, in a single bed for convenience, and receive the most careful nursing, for even the mildest onset may be followed by severe symptoms, and the strength should be husbanded from the beginning. The use of the bed-pan should be insisted upon, and after each evacuation the anal region should be washed with a carbolized lotion, and an ointment applied. Except in very warm weather, a thin woollen covering is useful in preventing chilling of the surface. Hot fomentations or poultices to the abdomen may give the patient a feeling of comfort and aid in relieving pain. There can be no practical value in blisters or in leeching along the line of the colon; but the use of ice locally, although it has not been much advocated, would seem to be a rational means of reducing the intense hyperemia of the earlier stages.

In selecting a plan of treatment it must be remembered that an extensive surface of the intestine is involved, that the inflammation is intense and rapidly progressing, with a tendency to necrosis and putrefaction of the necrosed tissue in the canal, that the patient is soon exhausted if the inflammation does not abate, and that there is great risk of the absorption of toxins. Underlying all these conditions, in a certain proportion of cases, is the undoubted presence in the intestine of the *amœba coli* as a cause, and the probable presence of other micro-organisms as causative agents in all other cases.

**Diet.**—The addition to the intestinal contents of food improperly digested and the fermentation and decomposition resulting therefrom add much to the danger. The question of diet is therefore an important one. Dysenteric patients must be fed, and yet, in the state of the intestine, perfect digestion and absorption are difficult. Food is to be given in small quantities, at short intervals, and of a kind that has the least waste. Milk, if given in large quantity, is one of the most objectionable of all foods, as imperfect digestion and fermentative decomposition follow its use. The presence of masses of casein in the stools is, to a certain extent, a guide to the advisability of discontinuing milk or diluting it with lime-water, barley-water, rice-water, or Vichy water. Peptonized milk may be tried also under these circumstances. The withdrawal of milk altogether and the giving of beef-juice, beef-tea, or broths, are sometimes followed by relief of the abdominal distress and by a change in the character of the stools.

As regards quantity, not more than from two to four ounces of food should be given, at intervals of two or three hours. In the earlier stage, with the hope of moderating the severity of the attack, a minimum quantity should be given. Later on, if the pulse is feeble and the patient exhausted, the quantity may be increased, but it must be remembered that the asthenic symptoms are not due to want of food, but to inflammation and a toxic condition. Strength is lessened and not increased by loading the intestine with decomposing food.

**Laxatives.**—The laxative method appears so rational that it has gained a firm foothold in popular favor; it is only liable to lose ground by being supported as a "method" and not as an aid to a combined effort to disinfect the intestinal canal by removing contents that irritate mechanically and by chemic decomposition.

If the case is seen early and if the stools are small and consisting of blood and mucus, the treatment can well be begun by a saline laxative, as magnesium sulphate, sodium sulphate, potassium and sodium tartrate, or by castor-oil, the dose to be repeated until a distinct effect is produced. In certain cases, especially in children, calomel acts very well and is to be preferred. The presence of hard fecal matter in the stools and the occurrence of watery fecal movements are evidences that the laxative has acted sufficiently.

As purgation increases peristaltic movement and irritates the mucous surface, it must, to a certain extent, be harmful in all cases, and is not to be advised if the stools are copious and fluid, or if there is much preliminary diarrhea. The question of repeating the purgative is one whose determination requires some judgment, and it is here that the belief in purgatives as a "method" may do much harm. If daily irrigation of the bowel is employed, there is rarely any necessity for repeating the cathartic, for, as improvement goes on, the fecal matter appears in the escaping fluid and the bowel is kept empty. At the end of a week or later a saline laxative should be given if, with subsidence of the inflammation, there are no natural fecal movements.

**Opium.**—The pain and the frequent stools suggest the use of opium, and in moderate doses this drug is of service; the objections to it are the danger of arresting peristalsis completely and causing an accumulation in the bowel of matters that are much better expelled. It is in cases with large, liquid, putrid stools that opiates do positive harm by arresting the discharges. Here, too, the irrigation-method, as will be shown hereafter, by keeping the bowel empty, removes much of the danger from this source. The indications for opium are intense abdominal pain, sleeplessness from pain or frequent stools, or an excessive number of stools. Dover's powder, deodorized tincture of opium, and morphin hypodermically, are the best forms for its administration. For many reasons the last is to be preferred, the doses being sufficient to subdue great suffering and to keep the nervous system in comparative repose. But any effect approaching narcotism should be most carefully avoided by giving small doses at first and at safe intervals. One must agree with A. Brayton Ball in "distrusting the fallacious effects of opium," and in advising against

the effort to cure dysentery by arresting the movements of the bowel. The accomplishment of this end means often the destruction of the patient.

There is very little to be said in approbation of any other medicines given by the mouth. The treatment by ipecacuanha retains its place in the books, but the Anglo-Indian method by large doses has never had a firm place in the practice of this country, and even its warmest supporters seem to be losing confidence in its superiority. Small doses of the drug are spoken of favorably, but there is no reason to think that they have any curative effect. The same may be said of the numerous drugs suggested from time to time. Astringents are without effect, and are harmful in that they derange digestion. Bismuth in large doses may prove of use, and in any event it does no harm.

Antiseptics given by the mouth, although not so efficacious as when injected into the lower bowel, may be employed in this way to supplement their more direct action.

The value of calomel in the treatment of dysentery no doubt resides in its antiseptic properties, and the time-honored combination with Dover's powder has some rational support; but to be of any service the drug should be given in small doses and kept up, in this combination, for several days. Corrosive sublimate in small doses, from gr. $\frac{1}{120}$ to gr. $\frac{1}{60}$ (0.00054–0.0011) every hour, is employed with the same object in view.

Other intestinal antiseptics can be much more readily and thoroughly used by injection and irrigation.

**Local Treatment of the Rectum and Colon by Suppositories, Injection, and Irrigation.**—The ancients washed out the bowel for the removal of "acrid humors," which they thought intensified the inflammation. Modern pathology has shown us that the ancients were right, and that if we could keep the bowel thoroughly clean and aseptic, as we do an external wound, we should be able to cure dysentery. Cold-water injections were used by Joseph Kent in 1826, and O'Beirne first used the long gum-elastic tube, "to give exit to the accumulated and pent-up contents of the cecum and colon." Hare used these words in 1849:

"The substance of the whole argument is this: The long tube changes a huge internal abscess into an external one, and enables us to wash out and cleanse from it its putrid contents. It also enables us to foment and soothe by local applications the sloughing and ulceration these contents have caused on the surface. . . . . Dysentery in its primary nature . . . is a mild and harmless disease and . . . therefore if we remove quickly these acrid secretions we shall disarm dysentery of its terrors."

Hare advises the frequent repetition of the process of cleansing whether the stools are solid or liquid.

As far back as 1774 the theory of antiseptic treatment was accepted. Peruvian bark, chamomile-flowers, calumba, charcoal, calcium chlorate, sodium hyposulphite, creosote, and other similar substances were successively employed.

In 1879 Cantani recommended disinfection of the colon in dysentery with

carbolic acid, sodium salicylate, sodium borate, etc., and predicted great success from this mode of treatment. Since this date there has been a confirmation of the prediction in the published reports of cases in the periodic literature of the world. One of the most interesting is that by Dr. Korytin,[1] but much on the same subject has appeared in America, and the articles in text-books have given a prominent place to the local method of treatment.

Three plans, however, are to be noted as being essentially unlike, whilst all are designed to act locally upon the inflamed surface. These are—

1. Treatment by suppositories and by small injections.

2. Treatment by large injections which are retained or are passed by the voluntary effort of the patient.

3. Treatment by lavage with large quantities of fluid, the immediate escape of the fluid being provided for.

A distinction must be made between these methods, as upon the choice of the best of them must depend success in the treatment of the case.

1. *Treatment by Suppositories and by Small Injections.*—The use of suppositories containing astringents, opium, or antiseptic drugs was at one time a favorite method of treating dysentery. When the inflammation is confined to the rectum, as shown by very small stools, containing blood and mucus, suppositories of the aqueous extract of opium or morphin relieve the tenesmus and the frequent efforts at stool. There is an advantage in using opium in this way in conjunction with preliminary irrigation, but care must be taken to use the smallest doses that will give partial relief, and no attempt should be made to arrest the discharges completely. The addition of an astringent to the suppository is inadvisable. The effect of cocain is not as favorable as might be expected from its anesthetic influence upon mucous membranes.

Small injections of starch-water and laudanum have a limited field of employment in the treatment of dysentery, but they do infinite harm if used without emptying and cleansing the rectum in advance. They are to be condemned if used to cure the dysentery by preventing the emptying of the rectum. Solutions of silver nitrate, containing gr. ½ (0.032) or gr. 1 (0.065) to the fluidounce (30.), together with from 5 to 10 drops of deodorized tincture of opium, not more than from f℥j to f℥ij (30.–60.) being used at a time, are recommended by Pepper, and are of service in cases in which the inflammation is confined to the lower bowel and is not of an intense degree. Stronger solutions act favorably if the rectum is ulcerated, but they are better adapted to the chronic forms of the disease. Small injections of astringents or of ice-water and the insertion of small lumps of ice have been also suggested.

2. *Injections of large quantities of water containing astringents or antiseptics in solution* are highly spoken of by all who have recently written on this subject. The object is the treatment of the colon throughout its whole length, the bringing of the drug in solution in direct contact with the inflamed surface, and also the cleansing and disinfection of the canal. The first question is as to how this should be done: if the fluid should be thrown into the rectum

[1] *Vratch*, xi., 1890, p. 957.

or if an effort should be made to pass the tube through the curves of the sigmoid flexure into the colon. In spite of what may have been said on this point, as a matter of fact the effort to pass the tube beyond the first turn of the sigmoid will usually be fruitless, as the tube will as a rule turn on itself. Even if success were more frequent there would be the serious objection that mechanical irritation of the mucous membrane is inevitable, and rupture of the wall of the bowel, thinned by ulceration, is possible.

Does fluid thrown into the rectum reach the colon? I have had the opportunity to demonstrate the facility with which this takes place, in the case of a fecal fistula in the cecum following an operation for appendicitis. Colored fluid was forced into the rectum with a Davidson's syringe, and under gentle pressure escaped in half a minute through the fistulous opening in the right iliac region. This was repeated so often and with such a uniform result that it leaves no doubt that nothing can be gained by making the tube pass through the sigmoid into the colon.

Alum, lead acetate, zinc sulphate, and other mineral astringents have been used for rectal injection in the proportion of half a dram (2.) or a dram (4.) to the pint (500.) of warm or cold water. Silver nitrate is perhaps more highly spoken of than any other drug of this class, and is to be used in the same strength. Tannic acid has also a special advantage, in being antiseptic and astringent while free from irritating properties. The objection to be made to all astringents used in this way is that they can do nothing more than cause contraction of superficial vessels, and can have no effect upon the parasitic element of the disease, nor upon the disintegration of tissue and the decompositions that are going on in the intestinal canal. They cannot therefore equal the antiseptics capable of destroying the cause of the disease and of preventing intestinal putrefaction. Solutions of any of the antiseptics may be introduced into the colon by rectal injection, but as they are so much more serviceable when used by irrigation they will be considered under this head.

Large volumes of water should always be introduced into the colon under low pressure. The inflamed state of the walls of the bowel must be borne in mind. Over-distention cannot but do harm, and a slow entrance will result in a distribution of the fluid throughout the colon without stretching the bowel. A fountain-syringe or a Davidson's syringe will be needed, or water can be poured into a funnel attached to the long tube. The tube should be at least from 24 to 36 inches in length and No. 27 English (41 French) in size—smaller tubes, of course, being used for children and in cases in which the rectum is intolerant of distention. It is very important that the openings in the tube should be large and velvet-eyed, and placed upon the side; tubes with an opening only at the extremity are worse than useless.

When the water is thrown into the bowel, it is allowed to remain for a few minutes or until the patient ejects it spontaneously. Koryton has reported sixteen cases of dysentery thus treated with excellent results. He employed warm water or warm carbolized water, and the fluid (six pounds) was allowed to remain in the intestine five, ten, fifteen, or twenty minutes. The feces became

thicker, lost their foul odor, and the mucus, blood, and particles of waste tissue disappeared, the fever subsided, and the general symptoms improved. The benefit followed immediately upon the washing of the bowel, and relapses due to the suspension of the measure were relieved at once by a return to the treatment.

The objection to this plan is that there is a certain amount of danger from over-distention of the bowel; the patient's suffering may be thereby increased and the disease aggravated. Again, the fluid injected may not be expelled, or only a small part of it may escape; there is therefore no washing out of the bowel or thorough disinfection of its contents.

3. *Irrigation of the Intestine.*—The difference between injection and irrigation is that the latter aims to clear the bowel of its decomposing contents as far as this may be done—to make it clean and to keep it so—to treat it therefore as an external wound would be treated according to antiseptic methods.

The patient lying on his left side or back and close to the edge of the bed, two soft-rubber tubes are passed into the rectum side by side, as far as they can be introduced without difficulty, which is about eight inches. A No. 17 English (29 French) tube is used for conducting the fluid into the bowel, and one of two sizes larger for the escape of the fluid. When the syringe is attached to the smaller tube the fluid is gently forced in. By moving the tubes up and down, the fluid will begin to flow, and thus an in-and-out current is soon established. It may be objected that the rectum only is washed in this way, but it will be found that it will require five minutes of washing before the escaping fluid becomes clear, and that shreds of mucus, blood-clots, and opaque fluid will continue to flow out long after the rectum is emptied, and for a time more enters than escapes; a current is established in the colon, and its contents are gradually washed out. That this is not done completely is not a legitimate argument against the method; frequent repetition of the irrigation will gradually make the bowel clean and keep it so.

Instead of two tubes, which often cause distress, one large-sized tube, No. 27 English (41 French), can be used alone. From 6 to 8 ounces of fluid are introduced and allowed to escape; and this procedure is repeated until two quarts or more have been used and the outflowing water is perfectly clean. In most cases the single large tube is much to be preferred, as being less painful to the patient and more thorough in its effect upon the contents of the colon.

The practical effect of this mode of treatment in every instance is first to lessen the frequency of the stools; their character next changes, putridity disappears, the blood and pus diminish, and after two or three days normal fecal matter may be present in the discharged fluid.

A cardinal point upon which I have insisted is that in dysentery the rectum is like an over-distended bladder, discharging its overflow, the contracting and irritable sphincter retaining a large residuum of decomposing fluid. If by suppositories or opiates the number of stools is diminished, no good, but a great deal of harm, is done. As a result of repeated irrigations the frequency of movement will gradually lessen until the evacuations take place only through

the tube, at the time of its introduction. This has been demonstrated so often that it may be said to be an invariable rule, and it is the more marked in cases of extensive colitis with large, foul-smelling fluid evacuations. If the irrigations are followed by much irritability of the rectum or by abdominal pain a suppository of gr. ½ (0.032) of the aqueous extract of opium may be introduced. In a short time, however, this may be omitted, or only used to quiet nervous irritability or induce sleep; but for this purpose a subcutaneous dose of morphin is best suited.

The quantity of fluid employed should vary from one quart (1 liter) to three quarts (3 liters), according to the intensity of the inflammation and the length of time required for the outflowing current to become clear. The procedure should be repeated at intervals of from three to six hours, the shorter interval for the severer cases; as the patient improves the interval should be gradually lengthened. Relapses should be met at once by a return to active treatment. The harmless antiseptics are to be preferred; hence, boric acid, tannic acid, salicylic acid, carbolic acid (1 : 2000), or naphthol (1 : 4000) may be employed. The first is the safest and the best, and as the desired result is to be reached rather by the frequency of the irrigation than by any peculiar quality of the drug used, boric acid will be in every way satisfactory.

Quinin (1 : 5000 or 1 : 2500 or 1 : 1000) is spoken of with special favor by Osler. Solutions of mercuric chlorid (1 : 5000 or 1 : 3000) have received the commendation of so many that they deserve trial in severe cases. Great care should be taken to secure an immediate evacuation of the fluid, as frequent irrigations with this drug involve obvious danger. Solutions of hydrogen dioxid can be conveniently used without risk.

Astringents, as alum, copper sulphate, lead acetate, and silver nitrate have a much more restricted use by injection and irrigation than drugs of the antiseptic class. The former may, however, be substituted for the latter when the intensity of the symptoms has abated and the discharges have become more diarrheal in character, or when there is a tendency for the disease to pass into the chronic form. Irrigations with silver nitrate, from 20 to 30 grains (1.3–2.) to the pint (500 c.cm.), are especially useful when the presence of pus in the discharges shows the persistence of unhealed ulcers. If these ulcers are in the rectum (and an examination ought always be made to see if this is the case), they may be touched through a speculum with strong solutions of silver nitrate or with carbolic acid.

During the progress of cases of dysentery, there are many special symptoms that will require treatment as they appear. The sleeplessness is combated best by morphin administered subcutaneously as already suggested; the failing action of the heart by alcohol, digitalis, and nitroglycerin.

When improvement begins there is danger in a too early enlargement of the diet, and caution should be exercised in the giving of solid food.

**Chronic Dysentery.**—It is best to confine this term to the designation of cases in which the symptoms are due to the persistence of the unhealed ulcers of an acute attack. The ulcers vary in number, size, and location; there may

be one, or the whole colon may be studded with them; they are small and disseminated, or the whole surface seems to be one extended ulcer, with intervening ridges of thickened, sometimes polypoid mucous membrane. The ulcerative process is not stationary, but fluctuates between extension and repair. The intestinal tube is dilated, contracted, or irregularly dilated and contracted. Amebic dysentery may have a subacute and prolonged course, the amebæ being found in the contents of the intestine, in the wall, and in the consecutive liver-abscesses.

The *symptoms* are frequent stools containing mucus, pus, and blood; sometimes the evacuations are diarrheal and stained with bile and containing unaltered food. They are either odorless or putrid. The general symptoms are anemia, emaciation, and debility; there are frequent intercurrent acute or subacute attacks, and the patients waste away and die from asthenia or from some one of the numerous complications.

The indication in *treatment* is to induce healing of the ulcers by rest, by appropriate diet, and by local treatment. In convalescence from the acute form relapses should receive the same attention as the original attack, and caution should be exercised in a return to the usual mode of life. The patient should not be considered well in cases of extensive ulceration until he has been free from symptoms for several months.

Rest in bed, with careful nursing, may be needed if the patient bears the confinement without detriment. In obstinate cases, with great impairment of general health, a change to a mountain climate may be necessary to give the necessary stimulus for recovery.

The *diet* should be regulated by the state of the digestion and the character of the stools. In many cases an exclusive diet of milk, peptonized milk, or koumiss should be tried faithfully for a month at least; if the patient tires of this, or if he loses weight, concentrated animal broths or raw scraped beef may be added to the milk-diet. As improvement takes place, rare beef or mutton, raw oysters, and some vegetable food may be cautiously given. The stools should be carefully examined, and any food that passes unchanged should be abandoned or prepared in some more assimilable form.

The administration of drugs to facilitate digestion or to relieve the symptoms of indigestion may be all that is required. Bismuth subnitrate in large doses—from 15 to 30 grains (1.–2.)—is always spoken of as having some special efficacy. Intestinal antiseptics are theoretically indicated, and bismuth salicylate, benzonaphthol, or others may be given to prevent the accompanying fermentative changes in the intestine. The most successful part of treatment, in association with rest and diet, is the local method—the cleansing of the ulcerated surfaces and the bringing of medicated solutions in contact with them. Thorough daily antiseptic irrigation cannot but favor the healing of ulcers, especially if these are seated, as is most usual, in the rectum and lower colon; but the whole length of the colon may be brought under antiseptic influence by adopting the plan suggested for the treatment of acute dysentery.

If there are ulcers in the rectum they may be touched through a speculum

with nitric acid, the rectum being first thoroughly cleansed and dried, and, after the application, washed out with a solution of sodium bicarbonate. Rest of the bowel should be secured for two days by an opiate suppository and in one week the ulcers may be again touched in the same way. For ulcers in the descending colon or even higher up, irrigation with solutions of silver nitrate—from 5 to 10 grains (0.32–0.65) to the pint (500 c.cm.)—once or twice daily, accomplishes the same purpose, the bowel being first emptied and made as clean as possible by irrigation with warm water.

Stricture of the bowel as a sequence of the healing and cicatrization of dysenteric ulcers is one of the most frequent and troublesome sequelæ of dysentery; if they are within reach they are successfully treated by dilatation and other surgical methods.

# MALARIAL FEVER.

By A. LAVERAN.

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Malarial fever is one of the few diseases that we are able to meet with a remedy that is, in the truest sense of the term, a specific. This remedy is found in cinchona and its derivatives, and the question of the treatment of paludism is therefore intimately connected with the history of cinchona and quinin, with the study of the mode of action of these drugs, and of the manner in which they are employed. Unless one has had the opportunity of observing the action of the salts of quinin on patients suffering from severe malarial infection, accompanied by symptoms belonging to the pernicious forms of the disease, it will be impossible to obtain a true idea of the services rendered by quinin in the treatment of paludism. In the simple intermittent fevers one or two doses of quinin are sufficient to dissipate the disease, as can be appreciated by an examination of the temperature-chart. The ascending and descending curves cease abruptly and are replaced by an almost continuous straight line. No other fever is cut short in this way by quinin, which is therefore with justice considered a veritable specific for paludism.

The history of the discovery of cinchona is well known. It will be remembered that the wife of the viceroy of Peru, the Countess d'El Cinchon, being attacked by an intermittent fever, was recommended by a corregidor of Loxa to use a powder which cured her. In 1640 the countess brought back to Europe some of the powder to which she owed her recovery and gave some of it to others, whence it received the name *Poudre de la Comtesse.* In 1649 the Jesuits of Rome received a large quantity of this powder and introduced it widely, and as a consequence it became known as the "Jesuits' powder." Finally, in 1679, Louis XIV., having been cured of an obstinate intermittent fever by means of a secret remedy given to him by an English charlatan named Talbot, purchased the secret for the sum of 48,000 francs and an annuity of 2000 francs, and commanded that the name of the remedy should be published for the public good.[1] The remedy was none other than a very strong vinous solution of cinchona.

Joseph de Jussieu, who was sent to America in 1735, says that the Indians of Malacotos, a village a few leagues distant from Loxa, were the first people to become acquainted with the antipyretic properties of the bark, which was at first designated by the name of Peruvian bark.

[1] *Le Remède anglois pour la Guérison des Fièvres, publié par ordre du Roi, par M. de Bléguy,* Paris, 1682.

Sydenham and Torti were the first to formulate rules for the proper employment of powdered cinchona in the treatment of malarial fever, and to defend the new remedy against its numerous opponents. Torti administered 8 grams (ʒij) of the powder of cinchona at a single dose after the paroxysm, in cases of simple intermittent fever. Sydenham's was the better method. He prescribed from 24 to 30 grams (ʒvi–ʒviiss) of powdered cinchona in doses of 2½ grams (grs. xl) every four hours, the first dose being given at the termination of the paroxysm; and he always took care to give after each dose a small quantity of wine. Thirty grams (ʒviiss) of powdered yellow cinchona correspond approximately to half a gram (grs. viij) of quinin sulphate.

It was not until the year 1738 that the tree which furnishes cinchona was described by La Condamine, who had been sent on a mission to Peru. In 1820 Pelletier and Caventon, after submitting the bark to the analytic procedures that Sertuerner had before applied to opium, discovered quinin and thereby rendered to therapeutics an immense service, as the employment of powdered cinchona in the treatment of acute malarial fevers was not without serious drawbacks, such as the difficulty encountered in administering doses sufficiently large and the slowness of absorption.

Cinchona is the bark of the trunk and of the branches of the cinchonas, trees belonging to the family of the Rubiaceæ. The cinchonas are indigenous to South America (Peru, Bolivia); they have been imported into Java, into the East Indies, and into the Island of Mauritius, in all of which countries they are now successfully cultivated.

In commerce three kinds of cinchona-bark are recognized—gray, yellow, and red. All three, however, can come from the same tree, gray cinchona being furnished by the bark of the small boughs, yellow cinchona by the bark of the boughs of medium size, and red cinchona by that of the large branches. There are also various species of cinchona-trees.

From cinchona-bark there have been extracted a large number of substances, of which the most important are the alkaloids, quinin, cinchonin, quinidin, and cinchonidin. Of these alkaloids quinin is the most efficacious and the one to which the preference must always be given in the treatment of paludism; I shall therefore occupy myself almost exclusively with the salts of quinin, but shall say also a few words about cinchonin and cinchonidin in speaking of the medicaments that have been proposed as substitutes for quinin.

The writings of Hippocrates contain descriptions that manifestly apply to malarial cachexia and to pernicious fevers. Malarial fever is therefore a very ancient disease, while on the other hand the discovery of the antipyretic properties of cinchona date, as we have just seen, only from the seventeenth century. For hundreds of years, then, the victims of paludism were deprived of the benefits of this specific medication. Many of these patients, however, when subjected to treatment of a more or less rational character, have nevertheless recovered. To-day one still finds, more especially in Africa, barbarous nations unacquainted with cinchona, and yet among whom cases of malarial fever often end in recovery.

When we come to study the numerous drugs that have been recommended to combat the different forms of malarial fever, we must never lose sight of the fact that these fevers can end in a cure, which may either be spontaneous or else be due to the influence of simply tonic medication.

The introduction into Europe of cinchona and the discovery of quinin by Pelletier and Caventon mark two grand epochs in the history of the treatment of paludism. The labors of Maillot[1] on the employment of quinin merit also a very prominent place. To Maillot belongs the honor of having shown that quinin sulphate ought not to be employed solely in the intermittent form of malarial fever, as had been thought before his time, but that its efficacy is quite as marvellous in the continued form. This happy therapeutic reform has saved many lives.

The discovery of the hematozoon of malarial fever has enabled us to explain the specific action of quinin in this disease. The recognition of the pathogenic agent concerned is to-day of so great importance in the history of malarial fever and of its treatment that it seems worth while to review here as briefly as possible our knowledge on this subject.

For a long time attempts were made to discover in the plants of the countries in which these fevers were prevalent, and in the fungi or in the microscopic algæ of the marshes where malaria existed, the pathogenic agent which by penetration into the organism set up malarial fever. The blame has been laid upon the marsh anthoxanthum, upon the rhizophora, a kind of alga akin to the oscillariæ (Hallier), upon a species of the genus *Palmella* of Salisbury, and upon a bacillus (Klebs and Tommasi-Crudeli).

In 1880 I described a parasite which has since been found by a large number of observers in every country in the blood of patients suffering from malaria, and which all are now agreed in considering as the pathogenic agent of this endemic disease. The parasite appears in several different forms, all of which, however, can be classified into four types, as follows: (1) Spherical forms; (2) flagella; (3) crescentic forms; (4) segmented or roset forms.

(1) *Spherical Forms.*—The spherical bodies represent the most common form of the parasites. They are often seen to be possessed of active ameboid movement, and for this reason some observers have proposed to give to them the name of "ameboid forms." They consist of a colorless, transparent, hyaline substance, and vary in size, the smallest having a diameter of scarcely $1\mu$, the largest being of the size of a red blood-corpuscle or a little larger. The contour of these bodies is indicated by a very fine line. The smallest of these elements enclose only one or two grains of pigment, and may even contain none at all. In the latter case they present the appearance of little transparent specks upon the red corpuscles. As these elements increase in size the grains of pigment contained in them become more numerous. These grains are arranged in the form of a fairly regular circlet, and are often very actively motile. The movements have neither the constancy nor the regularity of Brownian movements, to which, however, they present a certain analogy. Under observation

[1] Maillot: *Traité des Fièvres intermittentes*, Paris, 1836.

they diminish or increase in rapidity; sometimes they stop and recommence again without any change in the physical conditions to which the specimen of blood under examination has been exposed.

The spherical bodies are sometimes seen free in the blood, while at other times they are attached to the red blood-cells. Occasionally a single blood-cell contains two, three, or even four of these bodies.

The parasites live at the expense of the red blood-cells, which become paler and paler as the parasitic elements increase in volume, and finally disappear altogether. On careful examination of a spherical body with ameboid movement it is sometimes possible to see it divide into three or four elements similar to the first but of a smaller size. Sometimes also round plasmodial nodules are formed upon the edges. At the end of a variable space of time, which, however, rarely exceeds half an hour, the ameboid movement, as well as the movement of the grains of pigment, ceases and the spherical bodies present degenerative changes; their contour becomes irregular, and the pigment is massed together at certain points. By the aid of various methods of staining it is possible to demonstrate in the interior of the spherical forms the presence of a nucleus, which is situated, as a rule, not in the center, but is attached to the wall of the organism. Within the nucleus one can sometimes demonstrate certain granulations or nucleoli.

(2) *Flagella.*—On examining carefully a specimen of blood in which spherical bodies of moderate size are found free, we can frequently distinguish at the edges of these elements motile filaments or flagella in active motion which transmit various movements to the red cells near them. The red blood-corpuscles are indented, folded, and sometimes repelled, but they always regain their proper form as soon as the flagella leave their neighborhood. These movements may be compared to those of nematode worms which have been fastened by their tails and are trying to free themselves. The flagella, although measuring in length three or four times the diameter of a red blood-cell, are so delicate and so transparent that it is almost impossible to see them when they are at rest.

The flagella are derived from the spherical bodies. It is possible sometimes to witness this process of excapsulation. The number of flagella adherent to a single spherical body is a variable one; sometimes only one of these elements can be distinguished, while at other times there are two, three, or four. The movements of each flagellum are independent of those of the others. When three or four flagella arise from a single round body they become so entangled together that it is sometimes difficult to recognize their number and respective dimensions.

The movements of the flagella can be demonstrated in the blood immediately after it leaves the vessels, especially if the temperature of the laboratory is very warm. As a rule, however, they are much more easily seen at the end of fifteen or twenty minutes. It is possible that the movements are temporarily arrested under the influence of the chilling of the blood on leaving the body.

The free extremity of a flagellum often presents a small, pear-shaped swell-

ing, which, however, as the extremity is very motile, is only observable when it is exactly at the end. Besides these terminal nodes one sometimes sees small swellings that seem to change their position and move along the flagellum.

Sometimes the flagella are arranged symmetrically; at other times they are grouped at one point upon the spherical body.

When we first observe spherical bodies with flagella attached to them it is with difficulty that we can persuade ourselves that we are not in the presence of an animalcule provided with pseudopodia. This explanation seems all the more plausible because the flagella often impart to the spherical bodies more or less extended movements. Usually, however, we have to deal with movements of an oscillating character, the body being stationary; but sometimes, more especially if the layer of blood is a little thick, the whole spherical body undergoes a definite change of position.

The variation in the number of flagella and their irregular disposition are not at all in accordance with what we might expect if the parasites were furnished with pseudopodia, but the reason above all that should make us discard this idea is that at a given moment the flagella break loose from their attachments and move about among the red blood-cells. It is evident that from this moment each flagellum has an independent existence of its own.

After the flagella have been detached from the pigmented bodies to which they were adherent the latter lose their form and become immobile, the grains of pigment being massed together at one or more points.

(3) *Crescentic Forms.*—These elements are cylindric in shape and drawn out toward their extremities and generally curved in the shape of a crescent. The substance of their bodies is transparent and colorless, except toward the central portion, where there are found particles of black pigment identical with those seen in the spherical bodies.

The length of these crescents is generally a little greater than the diameter of a red blood-corpuscle, viz., about 8 or 9 $\mu$. It is worthy of remark that the crescentic bodies vary but little in size. Their breadth at the middle is about 2 $\mu$. The extremities of the crescent are sometimes drawn out, while at other times they appear rounded off.

Seen in a fresh specimen of blood the contour of the crescentic body appears as a single, very fine line, but it is easy to demonstrate a double contour in certain specimens which have been submitted to the action of osmic acid or of coloring reagents. One can often observe on the concave side a very fine line connecting the two extremities of the crescent; this line appears to represent a portion of the contour of the red blood-cell in which or upon which the parasite has developed.

Together with these crescentic bodies one often finds other elements which are hardly curved at all or in which the long axis is even straight. If a crescentic body is left in the microscopic field and examined at varying intervals it is sometimes possible to see it transformed into an oval body and later into a spherical body which is capable of giving rise to flagella.

(4) *Segmented or Roset Bodies.*—The segmented or roset bodies appear to represent, if not the sole mode, at least one of the principal modes of reproduction of the hematozoon of paludism. The margins of a spherical body which is either free or adherent to a red cell show slight indentations which in the beginning are very shallow. This appearance marks the first stage in the process of segmentation. At the same time the grains of pigment which before were scattered are collected into one mass at the center of the organism. The indentations soon become deeper and segmentation takes place, the spherical bodies being divided after a regular fashion into a series of segments presenting an appearance for which the qualification "roset" or "marguerite" has been invented. The segments become rounded off and separate one from the other, so that finally the segmented body is broken up into a series of small spherical bodies which become free.

Finally, in the blood of malarial patients we find hyaline, irregularly shaped, *pigmented bodies*, which are the degenerative forms of the parasites already described. In addition to these we have the *pigment-bearing leukocytes*, which are distinguished from the degenerative forms by the presence in them of one or several nuclei which can readily be stained with carmin or methylene-blue.

The presence of these parasitic elements is constant in the blood of patients suffering from malarial infection whenever the conditions are favorable for observing them. They are found in the greatest number during the febrile paroxysm, and more particularly at its commencement. They disappear rapidly from the blood after the administration of quinin, and are never observed except in cases of malarial infection. Sometimes the blood of the same patient contains all the forms described; sometimes only one or two varieties are seen. The spherical bodies are those most frequently met with.

Since the discovery of the parasite it has been found by numerous observers: by E. Richard, Soulié, Vincent, and Arnaud, in Algeria; by Sternberg, Councilman, Osler, James, in America; by Marchiafava, Celli, Golgi, Guarnieri, Pietro-Canalis, Grassi, Feletti, Antolisei, Angelini, Terni, Giardina, Bignami, Bastianelli, in Italy; by Van Dyke Carter and Evans in the East Indies; by Metchnikoff, Sacharoff, Khenzinsky, Romanowsky, Korolko, in Russia; by Paltauf, Kahler, Bamberger, Hochsinger, Mannaberg, in Austria; by Plehn, Quincke, Bein, in Germany; by Enrique Morado and T. Coronado, in Cuba; by Canton at Buenos Ayres; by A. Matienzo in Mexico; by F. Fajardo in Brazil; by Babès and Gheorgin in Roumania; and by Van der Scheer in Batavia. All of these observers admit that the parasite is the cause of paludism, but some difference of opinion exists as to the interpretation of the facts observed, and in particular on the subject of the connection that exists between the different forms of the parasite.

Several observers admit the existence of two or three or even five species of parasites, each giving rise to a different clinical form of the disease. Some hold, for example, that the crescentic bodies are not met with except in the irregular forms of malarial fever, and that the segmentation of the spherical

bodies that takes place in the tertian type is different from that which occurs in the quartan form of malarial fever (Golgi).

I am myself not of this opinion, but think on the contrary that the parasitic elements described, in spite of the variety of forms under which they are seen, ought to be considered not as belonging to different species, but rather as representing successive states of one and the same polymorphous parasite.

The small, unpigmented hyaline bodies which are seen as little transparent specks on the red blood-cells represent the embryonal form of the parasite. Little by little these bodies increase in size until they equal or even exceed that of the red blood-cells; at the same time the number of pigment-grains within them increases. The flagella are developed in these elements and at a given moment escape and become free. That a connection exists between the crescentic bodies, the spherical bodies, and the flagella seems just as certain.

The majority of observers are agreed that this hematozoon should be classed among the sporozoa, with the coccidia. It must be remembered that polymorphism is, so to speak, the rule in the history of these organisms.

It cannot, then, be doubted that the hematozoon described is the pathogenic organism that induces malarial fever. It is found in all countries in the blood of patients suffering from paludism, and is never met with in that of persons free from this disease. Quinin causes it to disappear from the blood at the same time as it cures the fever. Finally, it has been possible to induce malarial fever by injecting into the veins of individuals free from this disease a small quantity of blood taken from patients suffering from malarial fever. The hematozoon showed itself in the blood of the individual inoculated at the same time as the paroxysm of intermittent fever appeared (Mariotti and Ciarocchi, Marchiafava and Celli, Gualdi, Antolisei, and Angelini).

We shall now proceed to consider in order: (1) Quinin—its mode of action on the organism of the healthy individual and in cases of malarial fever; the toxicity of the salts of quinin, and the accidents that may result from their use. (2) The salts of quinin, and the different modes of administering them. (3) The dosage of quinin and the duration of the treatment to be prescribed in simple intermittent fever, in continued malarial fever, in the pernicious types, and in the malarial cachexia, and the measures that may be considered as adjuvants in the treatment with quinin. (4) The drugs that have been recommended as substitutes for quinin. (5) The prophylactic treatment of the malarial fevers.

1. **Quinin—its Mode of Action on the Organism of the Healthy Individual and in Cases of Malarial Fever; the Toxicity of the Salts of Quinin, and the Accidents that may Result from their Use.**—Of the alkaloids of cinchona, quinin, $C_{20}H_{24}N_2O_2$, is recognized as the most efficacious in the treatment of paludism. Quinin comes to us as a white substance, amorphous when anhydrous, slightly soluble in water (1 part in 400 parts of cold water and in 250 parts of boiling water), and very bitter. On account of its slight degree of solubility in water quinin itself is but little used, but instead one or other of its salts is almost always prescribed. Quinin is a diacid alkali which

by combining with acids can produce neutral or basic salts. When a molecule of quinin combines with a molecule of hydrochloric acid there is formed one molecule of basic quinin hydrochlorate; when it combines with two molecules of the same acid there results one molecule of neutral quinin hydrochlorate; it acts in just the same way with the other monobasic acids.

*Physiologic Action of Quinin.*—Quinin has a local irritant action on the tissues. The workmen engaged in the preparation of cinchona-bark or of quinin sulphate are subject to itching of the skin and to cutaneous eruptions (Girard, Chevalier). The irritant action of the salts of quinin is particularly shown when they are sprinkled upon the surface of the body from which the epidermis has been removed. When, for example, they are applied over the site of a blister there results great pain, with all the signs of an intense inflammation, sometimes with the production of a superficial eschar.

Hypodermic injections of the salts of quinin are no less painful, and often cause indurations, abscesses, or eschars, especially if the injection has been made into the skin itself and not into the subcutaneous connective tissue. This irritant action is fortunately but little marked on the mucous membrane of the digestive tract. Inflammation of the buccal or pharyngeal mucous membrane has never been observed as a result of the administration of quinin by the mouth, whether in powder or in solution. The gastric and intestinal mucous membrane bears ordinary doses of the salts of quinin very well, and it is only when this drug is administered in heroic doses and for a long time that symptoms of gastritis appear. Experience has shown that the fears expressed on this subject by Broussais and his followers were not well founded, and that one may with safety administer quinin even to patients who present marked symptoms of gastric disturbance, without any danger of provoking a gastritis or a gastro-enteritis, and without taking the precaution of first administering an emetic or a purgative. In certain individuals quinin is badly borne and induces vomiting, but such intolerance is very rare.

It has been a matter of much discussion whether quinin should be classed among the stimulants and irritants, as was held by Broussais, or rather among the depressants, as Rasori and Giacomini taught. Numerous experiments have been made upon healthy men and upon animals to solve this problem, and results have been obtained which at first sight would seem to be contradictory. Duval, after having taken 60 centigrams (gr. ix), and Beraudi, after having taken 1 gram (gr. xv) of quinin sulphate at a single dose, experienced a feeling of nervous excitement. The pulse was accelerated and there was some gastro-intestinal irritation. These observers concluded therefore that quinin sulphate was an irritant and a stimulant. Giacomini, experimenting with rabbits, found that a dose of from 12 to 13 centigrams (gr. ij) of quinin sulphate induced symptoms of poisoning which sometimes even proved fatal, and that the principal phenomena observed were those due to a depressant action, slowing of the pulse, etc. Mélier observed the same phenomena in dogs poisoned by quinin. Giacomini and Mélier conclude from these experiments that quinin is a cardio-vascular depressant. Briquet in his

treatise on cinchona admits that quinin is a depressant of the heart, of the arteries, and of the nervous system.

It is evident that the reason why the observers just quoted have arrived at such different conclusions with respect to the mode of action of quinin lies in the fact that the experiments were not made under the same conditions. The first, experimenting on men, gave small or moderate doses of quinin; the others, experimenting on animals, gave toxic doses—facts that will readily account for the contradictory results that were obtained. It is easy to understand that one and the same drug can act as a stimulant in small doses and as a depressant in large doses. A small quantity of alcohol stimulates, but when taken in large quantities this substance stupefies and has a depressant effect.

Quinin cannot be classed absolutely either among the stimulants or among the depressants, as its effects differ according to the doses employed. In small doses quinin induces in healthy men and in rabbits an acceleration of the heart's action and an elevation of the blood-pressure. In large doses it brings about a slowing of the heart's action, which is often preceded by an acceleration. Toxic doses finally cause an arrest of the heart in diastole (Bochefontaine and Laborde). When 1 gram (gr. xv) of quinin is administered to a healthy individual there appear certain phenomena due to stimulation, such as tinnitus aurium; sometimes we have a quinin-intoxication. Toxic doses produce in man and in animals stupor, prostration, or even collapse.

According to Binz, under the action of quinin the leukocytes lose their ameboid movement, and in consequence the diapedesis of these elements is interfered with. Hayem was not able to demonstrate this action of quinin upon the leukocytes, and observations upon the blood of malarial patients go to disprove Binz's statement. The leukocytes play an important rôle in the destruction of the hematozoa, and the action of the phagocytes, far from being inhibited by quinin, seems on the contrary to become more energetic and efficacious after the administration of this drug.

Piorry claims to have demonstrated even in the healthy individual a rapid diminution in the size of the spleen after the administration of quinin, and says that a true contraction of this organ takes place. Valleix and Briquet did not succeed in observing this phenomenon, though they placed themselves under the same conditions as Piorry, and the experiments made by Pagès are far from conclusive. Quinin has no appreciable influence on the dimensions of the spleen except in individuals suffering from acute malaria. While it breaks up the fever the drug causes at the same time a rapid diminution in the volume of the spleen. This takes place also even in patients suffering from malarial infection unaccompanied by pyrexia, unless indeed they have reached the cachectic state and fibrous changes in the spleen have already taken place.

In the healthy individual medicinal doses of quinin have but little effect on the temperature of the body. The administration of 2 grams (gr. xxx) of quinin sulphate will usually be followed by a slight lowering of the normal temperature, and the usual morning and evening variations are diminished or

entirely disappear. In most of the diseases accompanied by fever, such as typhoid fever, the eruptive fevers, acute rheumatism, erysipelas, etc., quinin has little influence upon the temperature-curve unless prescribed in heroic doses, and even then the resulting fall is very transient.

In fevers due to malarial infection, on the other hand, quinin acts rapidly, and a few doses are usually sufficient to break up the fever. It is very evident to any one who has prescribed quinin first in typhoid fever or in the fever due to rheumatism, and then in the fevers due to malarial infection, that in the last named quinin has a specific action that is very different from that which it has in the others.

*Mode of Action of Quinin in Malarial Infection.*—How, then, do cinchona and the salts of quinin cure malarial fever? This question has been proposed since the day when it was recognized that cinchona was the specific remedy for malarial diseases, but no satisfactory answer was forthcoming until the pathogenic organism of the disease was discovered. It is hardly necessary to mention the theories that at one time or another were put forward to explain the mode of action of quinin. Briquet[1] held that the salts of quinin acted on the nervous system at first with a stimulant influence, but later, as the use of the drug was continued and the dose was increased, the action became sedative. Experiments made upon healthy individuals and upon animals gave no clue to the explanation of the mode of action of quinin in paludism. To study upon the healthy individual or upon animals the action that quinin would have in cases of malarial infection would be just as irrational as to pretend to investigate the antiparasitic properties of sulphur-ointment by rubbing it upon the skin of healthy animals or of men not afflicted with the itch. On the other hand, as the salts of quinin are only to a slight degree inimical to bacteria and fungi, it was impossible to explain the mode of action of the drug as long as it was thought that the parasite of malaria belonged to one or another of these classes. Vulpian and Bochefontaine[2] opposed the theory of the antiparasitic action of the salts of quinin by arguing that the toxicity of these salts in the case of bacteria was very slight, and the same is true as regards the algæ and the fungi that have at different times been set down as the pathogenic agents in paludism. The palmella of Salisbury develops very well in a solution of quinin sulphate.[3] The penicillium can live and flourish in concentrated solutions of the salts of quinin.[4] The bottles that contain solutions of quinin sulphate if not frequently and carefully cleaned are almost always covered on their inner surfaces with fungi.

It is true that it has been proved that cinchona and the salts of quinin, although almost inactive against bacteria and fungi, are nevertheless very actively poisonous for the infusoria; but, so far were we from supposing that the pathogenic agent in paludism belonged to the animal kingdom that we could not base upon this property of the salts of quinin any theory as to their mode of action in malarial infection.

[1] *Traité thérap. du Quinquina*, Paris, 1855. [2] Bochefontaine: *Thèse de Paris*, 1873.
[3] Wood: *American Journal of the Medical Sciences*, 1868. [4] Bochefontaine, *loc. cit.*

As long ago as 1865, A. Chevalier[1] had observed that the smallest amount of cinchona introduced into an infusion of hay prevented the development of the infusoria. This action of quinin upon the infusoria was afterward studied by Binz and by Bochefontaine. With the knowledge that the pathogenic agent that is the cause of paludism is neither a fungus nor a bacterium, as had been so long supposed, but a protozoon, it has now become easy to explain the efficacy of the salts of quinin. The destructive action of quinin on the hematozoa of paludism is undoubted. These parasites disappear rapidly from the blood of patients undergoing treatment with quinin, and this very fact was in itself one of the causes that delayed the discovery of these organisms, the study of malarial blood having, as a rule, been made in the cases of patients who had already taken quinin.

It is possible to study directly the action of quinin on the hematozoa by mixing a drop of a solution of quinin sulphate with a drop of malarial blood. When this is done it is possible to observe that the hematozoa rapidly assume degenerative forms.

It may be objected that many substances possess antiparasitic properties superior to those of cinchona, and yet are not antidotes against malaria. If it were possible to introduce into the blood in sufficiently large doses parasiticides like iodin or mercury, the hematozoa of malarial fever would without doubt be destroyed just as well or even better than if the salts of quinin were similarly employed; but these agents are very powerful poisons for man, so that it is not possible to utilize them for killing even the parasites that have their habitat in in the upper portion of the alimentary canal.

The sensibility of the hematozoa to the action of quinin should not be surprising. Certain parasites are extremely susceptible to the action of substances that have no effect upon other parasites. Raulin has shown that a solution of silver nitrate in the proportion of 1 : 1,600,000 is sufficient to prevent the development of the aspergillus niger.

Among the forms assumed by the hematozoon of paludism there is one, the crescentic body, which is far more stubborn in its resistance to quinin than the others; but even the crescents will finally disappear under the influence of somewhat prolonged treatment.

Even when deprived of the help of quinin the system offers to the hematozoa more or less energetic resistance, and in this struggle the leukocytes appear to play the most important part. In my early papers on this subject I explained the destruction of the parasites during the paroxysms of fever by the action of the leukocytes.[2] Since that time Metchnikoff, Golgi, and Gamaléia have laid stress upon the rôle played by the high temperature in the destruction of microbes, and the theory of phagocytosis, so well defended by Metchnikoff, has taken an important place in general pathology.

The appearance in the blood of pigment-bearing leukocytes, which are often numerous after the paroxysms of intermittent fever, and more especially after the severe paroxysms, shows that the leukocytes take up the débris of

[1] *L'étudiant micrographe*, Paris, 1865, p. 529.

[2] *Traité des Fièvres palustres*, p. 479.

the parasitic elements and of the pigment that they contain. The leukocytes, however, not only carry away the degenerated forms but they also capture the living parasites. This can sometimes be demonstrated by direct examination of the blood, in which it is possible to observe leukocytes in the act of absorbing the parasitic elements. Danilewsky[1] has also proved that phagocytosis plays an important rôle in the destruction of the hematozoa in birds.

The human organism, when left to its own resources, is able, therefore, to free itself of the hematozoa, and it conducts the fight to much greater advantage when it is placed under the best general conditions. For this reason all debilitating causes interfere with the cure of paludism, while tonic treatment favors it. I have noticed the same thing in the case of animals whose blood contained hematozoa; under the influence of an abundant and nutritious diet it was possible to see the hematozoa disappear, while improper or insufficient food favored their development.

Patients suffering from anemia, from overwork, or from malnutrition are wont to have numerous relapses. On the other hand, with nothing more than good diet and rest one frequently sees the condition of patients with malarial fever change for the better; the anemia diminishes, the relapses are fewer and occur at longer intervals, and a cure can even be obtained without the help of active medication. All tonics consequently have a favorable action on the course of the disease.

*Toxicity of Quinin.*—Have the salts of quinin toxic properties, and what dose is sufficient to cause undesirable effects? Many erroneous ideas on this subject have been put forward, and even to-day quinin sulphate is by the laity charged with many misdemeanors that should in all probability be laid to the account of paludism, which alone is capable of producing them. The majority of those who suffer from malarial cachexia attribute to excessive use of quinin sulphate the hypertrophy of the spleen, which is, however, found in a far more marked degree in patients who have never taken quinin at all.

It is rarely necessary to give more than two grams (gr. xxx) of quinin hydrochlorate in twenty-four hours, even in the graver forms of malarial fever. This dose is generally very well borne, the patients complaining only of tinnitus aurium, and it has often been exceeded in the treatment of the pernicious types. In a case of pernicious malarial fever Maillot gave nine grams (gr. cxxxv) of quinin sulphate in twenty-four hours and cured his patient. Mouneret[2] ordered as much as eight grams (ʒij) of quinin sulphate daily in cases of obstinate neuralgia. Giacomini took from three to four grams (gr. xlv to gr. lx) of quinin sulphate daily for forty-seven days without any undesirable effects. Favier also took of quinin sulphate up to three grams (gr. xlv) a day in order to test the effects of this salt. Guersent cites the case of a lady who was made by her husband, a physician and a paranoiac, to take forty-one grams (more than 10 drams) of quinin sulphate in the course of a few days. This lady lost temporarily her sight, hearing, and speech; her body

[1] *Annales de l' Institut Pasteur*, 1890, p. 432.

[2] *Éléments de Pathol. méd.*, Paris, 1852, tome iii. p. 104.

grew as cold as that of a corpse; but all of these symptoms soon disappeared. "There does not exist, to my knowledge," writes Briquet, "a well-authenticated case of intoxication followed by death except that of this deranged physician, who, in order to cure himself of a slight fever, took the enormous dose of 220 grams (55 drams) of quinin in ten or twelve days, and who ended by succumbing to the prostration induced by it."[1]

Giacomini gives an account of a man who by mistake swallowed at one time twelve grams (ʒiij) of quinin sulphate. He suffered from some symptoms due to depression of the heart's action and of the nervous system, which, however, were soon overcome by the exhibition of stimulants. The following facts show that an equal dose of quinin sulphate can be the cause of death in an adult. Two soldiers, intending to take a purgative, instead of taking sodium sulphate, by mistake drank a solution of quinin, so that each received about twelve grams (ʒiij) of the salt. Half an hour after taking the medicine the men were seized with cramps in the epigastric region and with vomiting. They presented paleness of the face, dilatation of the pupils, hurried respiration, chilly feelings, a small, irregular, and slow pulse, sometimes hardly perceptible, together with tinnitus aurium, and symptoms of syncope. In the case of one the symptoms gradually disappeared; the other died of heart-failure.[2]

Certain persons have an idiosyncrasy for the salts of quinin, presenting quite alarming symptoms even when the drug is taken in small doses, but these cases are exceptional. Trousseau and Pidoux[3] saw at the hospital in Tours a young nun suffering from delirium for twenty-four hours as a result of having taken a gram and a quarter (gr. xx) of quinin sulphate at a single dose. Another patient, suffering from asthma, after having taken three grams (gr. xlv) of quinin sulphate at one dose was seized with tinnitus aurium; at the same time he complained of vertigo and a feeling of bewilderment, and suffered from persistent vomiting. Seven hours after taking the drug he was blind, deaf, and delirious. The symptoms disappeared spontaneously.

Rizu[4] reports the case of a woman who presented congestion of the face, followed by a pronounced attack of orthopnea and of urticaria every time she took quinin sulphate even in minute doses. Floyer[5] cites an analogous case in a man in robust health who could not take even the smallest dose of quinin sulphate, fifteen centigrams (gr. iiss) being sufficient to produce violent dyspnea and urticaria.

Grosskopff[6] has observed grave but not fatal results following the administration of two and a half grams (gr. xl) of quinin at a single dose.

Kobner[7] observed serious symptoms in the case of an infant to whom a hypodermic injection of thirty centigrams (gr. v) of quinin sulphate had been

[1] *Traité thérap. du Quinquina*, p. 585.

[2] Bailly: *Archives de Méd. milit.*, 1885, tome vi. p. 320.

[3] Trousseau et Pidoux, *loc. cit.*, tome viii. p. 487.

[4] *Bulletin de la Soc. des Méd. et Natur. de Jassy*, 1887. [5] *British Medical Journal*, 1886.

[6] *Therapeutische Monatshefte*, Oct., 1892. [7] *Bulletin générale de Thérap.*, 1890, p. 506.

given. There was a scarlatinoid eruption, severe colic, and a bloody discharge from the rectum. The same symptoms were produced by one-sixth of the dose of quinin sulphate taken by the mouth. Pispiris[1] of Athens has reported two cases of gastro-intestinal hemorrhage following the administration of quinin sulphate to patients suffering from malarial anemia.

Quinin sulphate sometimes causes hemoglobinuria. The urine is of a reddish or blackish color, and contains albumin and hemoglobin, but no red blood-cells are found. This condition has been thoroughly studied and described by Karamitzas and by Pampoukis.[2] Karamitzas cites the case of a student who was attacked with hemoglobinuria whenever he took quinin sulphate, even in as small a dose as thirty centigrams (gr. v). Pampoukis and Chomatianos have recorded several similar observations. According to Pampoukis cinchonin sulphate does not give rise to hemoglobinuria, and in his opinion it ought therefore to be substituted for quinin sulphate in cases in which the latter gives rise to untoward effects.

Tomaselli[3] maintains that quinin is capable of producing not only hemoglobinuria, but also an ictero-hematuric fever, which can easily be confounded with a similar form of fever occurring in hot countries. Spyridon Canellis[4] and Pasquale Muscato[5] have also recently recorded examples of hemoglobinuria caused by quinin. For my part I have never had the opportunity of observing a case of hemoglobinuria due to quinin, and it is difficult for me to comprehend why this symptom, which appears to be fairly common in Greece, should be so rare in Algeria.

It has been said that quinin favors abortion, but by refusing to treat a pregnant woman who is suffering from malarial fever we do not avoid this accident; nay, more, there is reason to fear that in such a case the fever may, especially in hot countries, assume a pernicious character. Pregnancy, therefore, must not be considered a contra-indication to the employment of quinin. In such a case we have only to proceed with more caution, and administer, especially at the beginning of the treatment, relatively small doses of quinin, unless the patient's life seems to be in danger.[6] In fine, if we except certain individuals in whom the use of quinin causes symptoms that appear far more dangerous than they really are, one may say that the employment of the salts of quinin, in doses necessary for the cure of paludism, is absolutely without danger. But although quinin rarely produces bad results, the physician ought never to forget that such a possibility exists. If he mistakes for symptoms of malaria the intoxication, vomiting, and depression of the nervous system due to quinin, he may be led to increase the dose of the drug, and may in consequence intensify the intoxication. Above all, great caution is necessary in administer-

[1] *Galenos*, Athens, 1890.

[2] Pampoukis: *Étude sur les Fièvres palustres de la Grèce*, Paris, 1888.

[3] *Congrès de la Soc. Italienne de Méd. interne*, Rome, 1888.

[4] "Analyse du Travail de Spyridon Canellis," *Archives de Méd. navale*, 1888, p. 476.

[5] Pasquale Muscato: *Gazz. degli Ospitali*, 1890.

[6] Bérard: *Bulletin méd. de l'Algérie*, 1892, p. 211. Merz: *Travaux du Comité d'Études des Maladies de l'Algérie*, Alger, 1893.

ing quinin for the first time to individuals of a nervous temperament. In such cases it is better not to commence with full doses, unless the gravity of the situation demands heroic treatment.

Laborde and J. Simon[1] have proved that impure quinin and quinin mixed, as it often is, with cinchonin sulphate, cinchonidin sulphate, or quinidin sulphate, is more likely to produce convulsions than pure and unadulterated quinin.

It is important, then, to prescribe pure preparations of quinin unadmixed with the other alkaloids of cinchona.

2. **The Salts of Quinin; the Advantages to be Gained by the Use of the Hydrochlorate and the Chlorhydrosulphate; Different Modes of Administration of Quinin.**—Since the discovery of quinin, powdered cinchona and the tincture of cinchona are no longer employed as antipyretics, but simply as tonics, more especially in the malarial cachexia.

The salts of quinin being numerous, the question naturally arises, to which one of them the preference ought to be given, and how the absorption of the drug is best and most certainly secured. Although the sulphate is more often employed than any of the other salts of quinin, the hydrochlorate is to be preferred.

Quinin hydrochlorate contains 81 per cent. of quinin, whereas the bisulphate contains only 59 per cent. The former salt is more stable, more soluble, and more easily to be obtained pure than the sulphate.[2] According to the results obtained by De Beurmann, by Regnauld, and by Villejean,[3] the salts of quinin, as regards the quantity of the alkaloid which they contain, and their solubility, ought to be classed as follows:

*The Salts of Quinin classed in order according to the amount of alkaloid which they contain.*

| | | | | |
|---|---|---|---|---|
| The basic hydrochlorate contains | 81.71 | per cent. | of | quinin. |
| The neutral hydrochlorate | " 81.61 | " | | " |
| The basic lactate | " 78.26 | " | | " |
| The basic hydrobromate | " 76.60 | " | | " |
| The basic sulphate | " 74.31 | " | | " |
| The basic ethylsulphate | " 72.16 | " | | " |
| The neutral lactate | " 62.30 | " | | " |
| The neutral hydrobromate | " 60.67 | " | | " |
| The neutral sulphate | " 59.12 | " | | " |
| The neutral ethylsulphate | " 56.25 | " | | " |

*The Salts of Quinin classified in the order of their solubility.*

| | | | | |
|---|---|---|---|---|
| 1 part of the neutral hydrochlorate is soluble in | 0.66 | parts | of | water. |
| 1 part of the neutral ethylsulphate | " " 0.70 | " | | " |
| 1 part of the neutral lactate | " " 2.00 | " | | " |
| 1 part of the basic ethylsulphate | " " 3.30 | " | | " |
| 1 part of the neutral hydrobromate | " " 6.33 | " | | " |
| 1 part of the neutral sulphate | " " 9.00 | " | | " |
| 1 part of the basic lactate | " " 10.29 | " | | " |
| 1 part of the basic hydrochlorate | " " 21.40 | " | | " |
| 1 part of the basic hydrobromate | " " 45.02 | " | | " |
| 1 part of the basic sulphate | " " 581.00 | " | | " |

[1] J. Simon: *Thèse de Paris*, 1883. [2] Dujardin-Beaumetz: *Soc. de Thérap.*, 23 Mars, 1887.
[3] *Bullet. gén. de Thérap.*, 1888.

Quinin hydrochlorate costs a little more than the sulphate, but as large a dose of the former is not required as of the latter. Quinin salicylate is very feebly soluble, 1 part dissolving in 1430 parts of water at 20° C. (68° F.). Besides, the salicylate contains only 70.12 per cent. of quinin.[1] The ethylsulphate and the hydrobromate, which have been recommended for hypodermic injection, give far less satisfactory results than the hydrochlorate. They are not only very unstable, but often produce local symptoms (abscesses, eschars) when employed hypodermically. Quinin lactate is not sufficiently soluble for hypodermic use. The chlorhydrosulphate, discovered by Grimaux in 1892, is very soluble, and appears to be preferable to all the other salts of quinin for hypodermic injection. Its richness in quinin is approximately equal to that of the sulphate, and it ought to be prescribed in the same doses as the latter.

*Modes of Administering Quinin.*—In ordinary cases of simple intermittent fever, quinin should be given internally, by the mouth; in the grave forms, which demand immediate action, recourse must be had to the hypodermic method. The latter mode of administration ought to be practised in the case of patients suffering from simple intermittent fever, who are not able to take quinin by the mouth, and in whom the drug causes vomiting. The hypodermic method of treating the malarial fevers is the most reliable and the most efficacious, but even under the most favorable conditions the subcutaneous injection of the salts of quinin is always somewhat painful. Besides, in practice numerous difficulties attend this mode of administration. It would be very difficult, especially in countries where malarial fever is prevalent, to give several times daily hypodermic injections to all victims of the disease. On the other hand, it is far more simple to prescribe a solution of quinin to be taken by the mouth.

*Administration of Quinin by the Mouth.*—Quinin may be given by the mouth either in solution, or in the form of powders, in capsules, or in pills; but, whenever possible, the solution should be preferred. In hot countries, especially where the pernicious form is to be feared, the physician will do well to make the patient take a solution of quinin in his presence. This method has been practised with great success for some time in the military hospitals in Algeria. When the physician makes his rounds he is followed by an attendant who carries a bottle containing a solution of quinin of fixed strength and also a glass graduate. As soon as the physician has prescribed a dose of quinin the attendant measures it out, and gives it to the patient on the spot. The capsules containing quinin and the pills which are given to be taken after the visit are often thrown away by unruly or apathetic patients. Besides, quinin when given in pill form is more slowly absorbed than when given in solution. When the pills are old and very hard they may even pass through and out of the alimentary canal without being dissolved. Quinin hydrochlorate in powder, given in pellets of dough, is preferable to pills. These pellets are easily swallowed after being molded in the fingers for a short time, and the patients do not perceive the disagreeable, bitter taste that belongs to solutions of quinin.

*Enemata of Quinin.*—When enemata of quinin are prescribed, it is never

[1] Antonesco: *Thèse de Paris*, 1877.

certain that they will not be rejected before absorption has taken place, and, moreover, one can never tell precisely what dose of the drug has gained entrance into the system. For these reasons the administration of quinin by the rectum is inadvisable, and this mode of employment should be adopted only in cases of necessity, for instance, when it is absolutely necessary to give quinin to a patient who is vomiting, or who cannot take the drug by the mouth, and when a hypodermic syringe and a convenient solution for injection are not at hand. In the case of children enemata of quinin are sometimes very useful, in view of the difficulty of making such little patients take medicine.

For an adult from 1½ to 2 grams (gr. xxij–xxx) of quinin hydrochlorate may be dissolved in 120 c.cm. (f℥iv) of warm water. It is better to add to the solution a few drops of tincture of opium in order that the enema may be better borne. The rectum should have been previously emptied by means of a large enema of warm water.

*Endermic Method.*—The endermic method, which consists in bringing about the absorption of the salts of quinin through the skin at a place where the epidermis has been removed, must be absolutely condemned. The salts of quinin, when applied to the raw dermis, provoke severe pain, an acute inflammation, and sometimes even superficial gangrene. Absorption also takes place with difficulty and slowly. Hypodermic injections are not only not productive of these local symptoms, but permit of the introduction into the blood of the necessary doses of the drug with rapidity and certainty.

*The Hypodermic Method.*—Quinin hydrochlorate is to be preferred for hypodermic injection on account of its solubility. The basic hydrochlorate is soluble only in the proportion of 1 part to 21.40 parts by weight of water, but the neutral hydrochlorate is much more soluble, 1 part being soluble in 0.66 parts of water.

De Beurmann and Villejean recommend for hypodermic injection the following solution:

℞ Quinin dihydrochlorate, 5. (gr. lxxv);
Distilled water, enough to make 10 c.cm. (f℥iiss).—M.

One cubic centimeter (♏xv) of this solution represents 0.50 (gr. viij) of the quinin dihydrochlorate.

When the solid dihydrochlorate is not obtainable, the basic hydrochlorate of commerce can be employed if the solution is prepared in the following manner: A certain quantity of pure hydrochloric acid is mixed with distilled water until the solution has a specific gravity of 1045 at 15° C. (59° F.); of this 5 c.cm. (♏lxxv) and enough distilled water to make 10 c.cm. (f℥iiss) are introduced into a graduated tube containing 5 grams (gr. lxxv) of basic quinin hydrochlorate. The filtered solution is clear, and of almost sirupy consistence; after a certain time it takes on a brownish color, without undergoing any other alteration. Although showing a decided acid reaction, the solution is not caustic. I have never observed eschars or gangrene in patients treated

with this solution, although the pain produced at the moment of injection is quite severe, and often lasts for several hours.

Kobner[1] recommends the following formula:

℞ Quinin hydrochlorate, 0.50–1. (gr. viij–xv);
Pure glycerin,
Distilled water, āā 2. (fʒss).—M.

The solution should be injected lukewarm.

Triulzi has shown that antipyrin has a marked influence on the solubility of quinin hydrochlorate. When from 40 to 50 centigrams (gr. vj–viij) of antipyrin are added to 1 gram (gr. xv) of quinin hydrochlorate the latter is dissolved in 2 c.cm. (fʒss) of distilled water at a temperature of from 25° to 30° C. (77°–86° F.). This solution has in my hands yielded good results. The injections were less painful than when the solution of the dihydrochlorate was used.

The addition of a small quantity of antipyrin to the quinin is not injurious. Grimaux[2] has proposed the following solution for hypodermic injection:

℞ Quinin chlorhydrosulphate, 5. (gr. lxxv);
Distilled water, 10. (fʒiiss).—M.

One cubic centimeter (♏xv) of this solution contains 0.50 (gr. viij) of the chlorhydrosulphate.

In my opinion, it is advisable to employ a slightly less concentrated solution, and I therefore prefer the following:

℞ Quinin chlorhydrosulphate, 10. (ʒiiss);
Distilled water, 30. (fʒj).—M.

One cubic centimeter (♏xv) of this solution contains 0.33 (gr. v) of the chlorhydrosulphate. This solution keeps well; no crystals are formed in it, and the injections are much less painful than those made with the neutral hydrochlorate.

Finally, one can employ for hypodermic injection quinin sulphate which has been rendered soluble by the addition of "L'eau de Rabel"[3] or of tartaric acid. Vinson gives the following useful formula:

℞ Quinin sulphate, 1. (gr. xv);
Distilled water, 10. (fʒiiss);
Eau de Rabel, 1. (♏xv),
Or, Tartaric acid, 0.50 (gr. viij).—M.

[1] *Bullet. gén. de Thérap.*, 1890, p. 506.

[2] Grimaux: *Soc. de Biologie*, Oct. 29, 1892; Grimaux and Laborde: *Acad. de Méd.*, 14 Février, 1893.

[3] Pure sulphuric acid (sp. gr. 1.84), 100.;
Alcohol (90 per cent.), 300.;
Petals of corn-poppy, 4.

Although hypodermic injections of the salts of quinin are of great service in the treatment of malarial infections, and although one can say that, thanks to them, the prognosis in the pernicious forms has become less grave than it was formerly, it must not be forgotten that they can cause local complications, such as abscesses, phlegmons, or eschars, and that everything possible should be done in order that these may be avoided. Great care should be taken to plunge the point of the needle well into the subcutaneous connective tissue. The injections made into the dermis itself are almost sure to produce local symptoms.

The solutions of quinin employed should be clear, and should contain neither crystals nor spores. Fungi develop in them very readily. If there are crystals in suspension in the solution this should be heated in a water-bath; if spores are present the solution must be filtered and sterilized by being boiled. The syringe, as well as the surface of the skin at the site chosen for making the injection, must be sterilized.

*Intravenous Injections.*—Baccelli[1] has recommended the injection of quinin hydrochlorate into the veins. The following solution may be employed:

| | | |
|---|---|---|
| ℞ | Quinin hydrochlorate, | 1. (gr. xv.); |
| | Sodium chlorid, | 0.75 (gr. xij); |
| | Distilled water, | 10. (f℥iiss).—M. |

The solution is clear when warm. After placing a ligature on the upper part of the forearm so as to cause distention of the veins, the needle of a Pravaz syringe is introduced from below upward into one of the veins, by preference into a small one, in order to avoid any escape of blood after the puncture. The syringe, which has a capacity of 5 c.cm. (ℳlxxv), is filled with the quantity of the solution to be injected, and connected with the needle before the vein is punctured. The injection is made slowly after the ligature has been removed. No nodular swelling should be produced at the site of injection, as this would indicate that the point of the needle is not in the lumen of the vein. The most rigorous antisepsis is indispensable, and the solution of quinin should have been boiled several times. After the needle has been withdrawn the puncture is covered with collodion. Baccelli has never met with any serious accident. In one case an abscess formed, and in two cases there was some edema of the forearm.

As, however, the method of hypodermic injection enables us to introduce the salts of quinin into the general circulation almost as rapidly as when they are injected directly into a vein, and as the former procedure is without danger, it is difficult to see why intravenous injections should be preferred, inasmuch as they are more difficult to practise, and are likely to cause local or general effects which may be very serious.

In any case we should not have recourse to intravenous injections except in the very severe pernicious paroxysms, and when there is reason to fear that even the hypodermic method will not effect a sufficiently rapid introduction of

[1] *Riforma médica*, Jan., 1890, and *Gazz. degli Ospitali*, Feb., 1890.

the salts of quinin into the blood—as might happen, for instance, in pernicious choleriform cases.

The absorption and elimination of quinin are rapidly brought about. Quinin appears in the urine in from fifteen to seventeen minutes after it has been taken by the mouth; in from twenty to twenty-five minutes after it has been introduced into the body by the rectum; and in from thirteen to fifteen minutes after it has been injected subcutaneously (Binz, Kerner, Lepidi-Chioti).

According to Kerner, all of the quinin absorbed is eliminated within from thirty-six to forty-eight hours. To demonstrate the presence of quinin in the urine the reagent of Bouchardat may be used. The formula is as follows:

| | |
|---|---|
| Iodin, | 15. (ℨss); |
| Potassium iodid, | 4. (ℨj); |
| Water, | 300. (fℨx). |

The addition of a certain quantity of this solution causes a chestnut-yellow precipitate in urine that contains quinin. Kerner has utilized the fluorescent properties of the salts of quinin to demonstrate the presence of most minute quantities in the urine.

**3. The Use of Quinin in Intermittent Fever, in the Continued Malarial Fevers, in the Pernicious Types, and in the Malarial Cachexia; Duration of Treatment; Supplementary Medication.**—Patients suffering from intermittent fever are often satisfied with having the fever broken up with two or three doses of quinin, and then waiting for a return of the paroxysms before resuming treatment. This method is most undesirable. We should, on the contrary, strive by means of continued treatment to prevent a relapse; otherwise we succeed only in controlling a few paroxysms, and the parasites, temporarily arrested in their development, speedily renew the process of propagation, and the whole task has to be begun anew.

Sydenham understood the necessity for continued treatment with quinin in intermittent fever. He says, "Quinin, notwithstanding its efficacy, cannot completely destroy the disease. . . . The best way of preventing a relapse is to give repeated doses of the febrifuge even after the cessation of the fever;"[1] and later on, "Lest the fever should return I never fail to give to the patient exactly on the eighth day after the last dose of cinchona the same quantity as before. To make quite certain that there shall be no relapse, the treatment must be renewed three or four times."

Experience shows that two or three doses of quinin are sufficient to break up an intermittent fever, but the fever usually reappears at the end of seven or eight days. After having broken up the fever, therefore, it is necessary to renew the treatment six or seven days after the occurrence of the last paroxysm.

One might, of course, administer quinin without interruption for a fort-

[1] Sydenham: *Methodus curandi febres.* French translation in the *Encyclopédie des Sciences médicales*, p. 155.

night or three weeks, but this course would not be desirable. Quinin, especially in the case of certain patients, gives rise to unpleasant nervous symptoms, such as tinnitus aurium and deafness. Besides, the treatment would become expensive, a consideration of some importance for many patients, and which ought to be considered by physicians in hospitals. Moreover, it has never been proved that continuous treatment with quinin is more efficacious than the interrupted treatment that I myself favor.

Better results are obtained by giving a few large doses than by prescribing quinin for a long time but in small daily doses. The reason for this can be easily understood. It is evident that if a gram (gr. xv) of quinin hydrochlorate is exhibited in one dose the blood at a given moment is charged to a much greater extent with quinin, and is therefore much more toxic for the hematozoa than if 25 centigrams (gr. iv) of quinin hydrochlorate are given daily for four days.

The type of the fever ought in my opinion not to sensibly modify the method of treatment, after we have once been assured by an examination of the blood that the fever is indeed due to malarial infection. As an example, we might prescribe for a male adult: On the 1st, 2d, and 3d days, from 80 centigrams to 1 gram (gr. xij–xv) of quinin hydrochlorate daily in the course of twenty-four hours; on the 4th, 5th, 6th, and 7th days, no quinin; on the 8th, 9th, and 10th days, from 60 to 80 centigrams (gr. ix–xij) of quinin hydrochlorate; from the 11th to the 14th day, no quinin; on the 15th and 16th days, from 60 to 80 centigrams (gr. ix–xij) of quinin hydrochlorate; from the 17th to the 20th day, no quinin; on the 21st and 22d days, from 60 to 80 centigrams (gr. ix–xij) of quinin hydrochlorate.

Should the fever reappear during the course of treatment this must necessarily be prolonged. I do not contend that any one rule can be applicable to all cases of paludism. The method just given must often be modified, especially in the serious forms of malarial fever in hot countries. The doses suggested are those that ought to be prescribed for an adult, and of course they must be considerably diminished in treating malarial fever in children.

In the case of children of four years of age and upward, from 30 to 40 centigrams (gr. v–vj) of quinin in divided doses may be prescribed daily. Children of from two to four years of age should receive from 20 to 30 centigrams (gr. iij–v); children of from one to two years, from 10 to 20 centigrams (gr. jss–iij). In the case of infants under twelve months of age from 5 to 10 centigrams (gr. ¾–jss) of quinin hydrochlorate may be given by rectal injection (J. Simon). In the serious attacks in children we should without hesitation have recourse to the hypodermic method, especially as the little patients often refuse to swallow pills of quinin, and because rectal injections are not to be depended upon.

As a general rule it is useless to prescribe emetics or purgatives, as was formerly the custom, before administering quinin; nay, the practice is even dangerous in the countries where the more serious types of malarial fever prevail. The employment of emetics delays the administration of quinin,

and while attempts are being made to calm the gastric disturbance a pernicious paroxysm may carry the patient off. On the other hand, by administering quinin at once a speedy reduction of the fever is effected, while the gastric disturbance disappears at the same time.

Bloodletting, which was much in vogue formerly, is, in the majority of cases, quite as useless as purgatives. Venesection and the repeated application of leeches have the undesirable effect of increasing considerably the anemia in a disease which in itself tends to bring about this condition. In certain paroxysms of the pernicious type, accompanied by coma and very evident signs of cerebral congestion or meningitic complications, it may, however, be necessary to have recourse to bleeding.

There has been much discussion as to the exact time at which quinin should be administered in intermittent fever, and most authorities agree that it should be given during the stage of apyrexia. Quinin is better borne at this time than during the paroxysm itself; it less often produces vomiting, and the drug is probably more easily absorbed. Moreover, one cannot expect to stop the course of a paroxysm when it has once begun. It should be insisted upon, however, that in the grave forms and in the continued types of malarial fever one should not wait for the intermissions, or even the remissions, for the administration of quinin.

There was a time when it was considered dangerous to employ quinin in the case of patients suffering from continued fevers, and it was thought that its use should be strictly limited to the intermittent forms. Under the influence of this doctrine the mortality from malarial fever in hot countries was enormous. Much praise is due to Maillot[1] for showing this teaching to be erroneous, and that quinin should be administered in the continued malarial forms. This therapeutic reform has brought about the most happy results, and the truth of the views of Maillot on the continued malarial fevers and their treatment is to-day universally admitted. In the grave forms hypodermic injections of from $1\frac{1}{2}$ to 2 grams (gr. xxij–xxx) of quinin hydrochlorate daily, in two doses, should be employed without regard to the temperature. As soon as the fever has fallen the treatment already indicated for the simple fevers should be resumed.

*Treatment Supplementary to that with Quinin.*—In the malarial fevers accompanied by pernicious symptoms the first indication, and by far the most important, is to exhibit quinin in large doses, hypodermic injections being employed in order that absorption may be as rapid as possible. Often, however, it will be advisable after this indication has been met to prescribe certain adjuvants to the specific treatment. In the case of patients suffering from the algid form, either simple rubbing or frictions with some stimulating liniment, such as camphor-liniment, may be employed. Hot stimulating drinks, such, for example, as tea with some form of alcohol, may be prescribed. Diffusible stimulants, such as ether or ammonium acetate by the mouth, or, better still,

[1] Maillot: *Traité des Fièvres ou Irritations cérébro-spinales intermittentes*, Paris, 1836; *L'œuvre de T. C. Maillot*, Alger, 1893.

hypodermic injections of ether (from 2 to 4 c.cm.—f℥ss–j) may be given. These injections are also very advantageous in the case of patients suffering from the choleriform types of malarial fever.

In the continued fevers, with a typhoidal condition and hyperpyrexia, cold baths are sometimes indicated. In the attacks accompanied by coma, when we have to deal with vigorous and full-blooded patients, and signs of serious cerebral congestion or of meningitis are present, leeches may be applied to the mastoid processes with a view of preventing subsequent inflammation. Applications of cold to the head, of warmth to the extremities, and drastic purgatives are equally useful.

Chloral hydrate (from 2 to 3 grams—gr. xxx–xlv, in sirup) is of great service in combating the delirium that sometimes appears with the pernicious types, and in alcoholic patients suffering from malarial fever. When vomiting is present the carbonated waters, champagne, and ice are indicated. A hypodermic injection of morphin hydrochlorate in the epigastric region often succeeds in allaying the vomiting, and if there is much diarrhea, opium and bismuth subnitrate may be given internally. In the bilious forms, ipecac and calomel are very useful, but in these cases also it is of the utmost importance to give quinin at the very beginning.

Although quinin may be looked upon as the specific remedy in paludism, we must not think that we have done all that is necessary in a case of malarial fever when we have prescribed this drug. A patient who has passed through an attack of malarial fever is weakened, anemic, and consequently predisposed to a relapse or a recrudescence of the disease. We must, therefore, endeavor, after the fever has been once broken up, to repair the damage done the organism by the malarial poison. Speaking generally, it may be said that all weakening factors interfere with recovery, while tonic medication favors it. Patients who are anemic, exhausted, and badly nourished suffer from continual relapses, to prevent which even the salts of quinin themselves become, so to speak, powerless. On the contrary, under the unaided influence of good diet and of rest, amelioration of the symptoms often takes place; the anemia diminishes, the relapses occur less frequently and at longer intervals, and without the intervention of any more active medication recovery can take place, simply from the fact that the organism has been placed under good hygienic conditions. All tonics, therefore, have a favorable action on the course of the disease, and among the best of these must be placed wine and coffee.

Arsenic, iron, and the tincture of nux vomica are also often very useful. Boudin was wrong in recommending arsenic as the only drug that should be used in malarial conditions. We shall refer to this point later on, but wish to say here that arsenic in small doses is an excellent reconstructive, and as such is to be recommended in these cases.

After the patient has been submitted to treatment with quinin as already described, arsenous acid (six or eight granules of one milligram—gr. $\frac{1}{60}$—each, daily) may be prescribed. Boudin's solution (arsenous acid in water, 1 : 1000), Fowler's solution, or Pearson's solution may also be used. Fowler's solution

(of potassium arsenite) may be given in doses of from 10 to 20 drops daily. Pearson's solution (of sodium arsenate) is less active than Fowler's solution, 12 drops representing one milligram (gr. $\frac{1}{60}$) of sodium arsenate. Fowler's solution yields the best results in children over two years of age. It should be given at first in doses of 2 drops (to be taken with food), increased gradually to 10 drops, after which the dose is gradually diminished to 2 drops. The administration is then discontinued, to be renewed at the end of eight or ten days (J. Simon). The administration of arsenic ought to be continued for a long time, but the drug should be given in small doses, so as not to produce gastro-intestinal disturbances. If diarrhea occurs the treatment should be suspended.

Nux vomica is an excellent stomachic tonic which agrees very well with patients who have been weakened and rendered anemic by malarial infection, and in whom the digestive functions are often torpid; the tincture of nux vomica stimulates the appetite, tones up the muscular system, increases the digestive powers, and consequently enables the organism to regain what it has lost. For an adult the tincture of nux vomica should be prescribed in doses of from 5 to 15 drops with food, morning and evening.

Cinchona, in the form of the extract or the wine, is also indicated in these cases. This drug possesses, in fact, marked tonic properties superior to those of quinin sulphate itself. One can prescribe, for example, some of the wine of cinchona to which extract of cinchona has been added. It is the custom to give the wine of cinchona before meals, and generally this procedure has no undesirable effects. In the case of patients who are very weak, dyspeptic, or in whom cinchona causes gastric pain, we could follow the advice of Vallin, who gave the cinchona during the meal. The drug is thus mixed with the food, and consequently is less irritating to the mucous membrane of the stomach; but when it is given in this way the absorption of the active principles appears to be less complete than when it is taken fasting. Besides, the cinchona performs in this case only very incompletely its function as an appetizer, a function that is very important.[1]

Hydrotherapeutic measures are important, and come under the head of tonic medication.[2] They succeed sometimes when all other measures have failed; it must be remembered, however, that when recourse is had to them the first few cold douches may provoke a relapse. It is therefore necessary to proceed with caution, and begin with lukewarm douches of short duration before giving the cold douches. They should not be applied directly over the spleen, and a few doses of quinin should be prescribed in conjunction with the douches. It is easy to understand how a cold douche, especially if directed immediately upon the splenic region, should be followed by a paroxysm, as the vessels in the spleen are contracted, and the hematozoa, which are always present in large numbers in the spleen, are sent into the general circulation. Patients suffering from

[1] Griesinger: *Infectionskrankheiten.* French translation; note by M. Vallin, p. 104.

[2] See Fleury: *Traité pratique, raisonné d'Hydrothérapie,* Paris, 1856. Fourcade: *Du traitement des Fièvres intermittentes par l'Hydrothérapie,* Thèse de Paris, 1872. Beni-Barde et Materne: *Hydrothérapie dans les Maladies chroniques,* Paris, 1894.

malarial infection who go to the baths of Vichy or elsewhere, and take the waters internally as well as making use of them in the form of baths, often suffer from such relapses at the commencement of the treatment, unless precautions are exercised.

If change of climate has a very favorable effect upon patients who have contracted the fever in hot countries, it is on account of the bracing influence exercised. The intense heat is very debilitating, and the excessive perspiration, the sleepless nights, and the dyspepsia with which foreigners who go to live in hot countries almost constantly suffer, weaken the organism and prevent it from repairing its losses and renewing the proper constituents of the blood. It is therefore not surprising that rapid benefit results in patients who can exchange a hot climate for one that is temperate, where they can regain their sleep and appetite.

Tonic and reconstructive medication should, naturally, be all the more insisted upon when the anemia is very marked. In individuals suffering from cachexia it will be necessary to employ such treatment for a long time, and, of course, quinin must be resorted to with every recurrence of the fever.

After the malarial infection has induced a cachectic condition a change of climate is indispensable. One could hardly expect to cure a case of paludism in which the cachectic stage has been reached as long as the patient remains in the locality in which the fever was contracted. Admitting that one could succeed in destroying the hematozoa by prolonged treatment with quinin, the patient would not fail after a short while to become reinfected, and all the more readily because he is feeble and anemic; for, unfortunately, malarial fever is far from being one of those diseases one attack of which confers immunity to subsequent infection; on the contrary, one attack predisposes to others.

*Treatment of Enlargement of the Spleen.*—Many modes of treatment have been recommended for the enlargement of the spleen, which is often enormous in the malarial cachexia. Quinin, which is generally blamed by the laity for the production of this hypertrophy of the spleen, has quite the contrary effect, so that in the fevers of short duration it is not necessary to pay any attention to the enlargement of the spleen, as quinin by itself brings about a rapid diminution in the volume of this organ. In the malarial cachexia, however, this is not the case. The spleen remains voluminous in spite of the prolonged employment of the salts of quinin. Counter-irritation (blisters, the cautery), applied over the splenic region, is indicated when there is pain, a sign of perisplenitis, which is not uncommon, but, one might say, is almost constant in malarial cachexia. Cold douches directed over the splenic region often produce good results. In order, however, to avoid a recurrence of the fever, quinin should be prescribed as a preventive at the beginning of this treatment.

In cases of hypertrophy of the spleen from malarial infection Mosler[1] employed local applications of ice and injections of Fowler's solution (1 c.cm.

[1] *Deutsches Archiv*, 1875, p. 409. Griesinger, *loc. cit.*, p. 116; note by M. Vallin.

of a 10 per cent. solution), or of a solution of carbolic acid (1 : 200) into the substance of the spleen itself through the abdominal wall.

Botkin[1] recommends the use of electricity in the treatment of splenic hypertrophy. It appears certain that the spleen, when of normal size, or when simply congested, can diminish rapidly in volume under the influence of the electric current. This fact is easily understood when we consider that the spleen is an essentially vascular organ, and that the mere contraction of its vessels will result in a diminution of its volume. When, however, a malarial spleen is simply congested, it recovers its normal volume without much difficulty, and without the necessity of recourse to the electric current; on the other hand, when the enlarged spleen is fibrous, electricity seems no longer to exercise much influence over it.

Murri, of Bologna, and Boari claim to have obtained good results from the injection of sterilized water into the hypertrophied spleen, employing in this way every day for fifteen days about one cubic centimeter (ℳxvj).

Intra-splenic injections of ergotin and of ergotinin have found advocates, but the facts cited in support of this medication are not very convincing, and the injections, which are not unattended with danger, are not to be recommended.[2]

Splenectomy has been performed a number of times in cases of splenic hypertrophy of malarial origin. Kœberlé[3] performed the operation twice, but both patients succumbed speedily. The Italian surgeons have performed splenectomy with success in several cases of malarial cachexia.[4] As a rule, unless special indications exist, such as marked mobility of the spleen, acute pain, etc., I think that splenectomy is contraindicated in paludism. Supposing even that the methods of treatment just laid down are not successful in diminishing the splenic tumor, it must be remembered that it is quite possible for a patient to live for a long time with a voluminous spleen; the majority of the inhabitants of malarial districts have large spleens, and are nevertheless often able to continue in the pursuit of occupations that are quite laborious. An operation so serious as splenectomy ought not to be undertaken except when the life of the patient is threatened.

**Substitutes for Quinin; Cinchonin, Cinchonidin, Arsenic, Iodin, Methylene-blue, etc.**—A large number of substances, belonging some to the mineral, some to the vegetable kingdom, have been proposed as substitutes for quinin, and whenever a new antipyretic has been discovered a greater or smaller number of cases of cure of intermittent fever by its use have been reported. Before enumerating these proffered substitutes for quinin, I wish to say a few words as to the conditions under which an experimenter ought to place himself before beginning a trial of any antipyretic in cases of malarial infection. In the first

[1] *Die Contractilität der Milz*, Berlin, 1874.

[2] Messerer: *Des Lésions viscérales dans l'Impaludisme;* Thèse de Paris, 1886. Brancaccio and Solaro: "Du Traitement direct de la Tumeur splénique palustre," *Gl'incurrabili*, 1892. *Revue d'Hayem*, 15 Avril, 1893.

[3] *Société médicale de Strasbourg*, 1 Mai, 1884.

[4] Gangitano: *La Riforma medica*, Aug. 3, 1893.

place it must be remembered that many cases of intermittent fever, especially in countries belonging to the temperate zone, recover without the employment of any specific medication. The entrance of a patient into a hospital is often sufficient to cause the disappearance of the fever. Rest, good diet, tonics such as wine and coffee, often by themselves bring about such results. Any drug given to patients of the kind mentioned at the moment of their entrance into a hospital will appear then to possess antipyretic properties, if we judge in accordance with the maxim *post hoc ergo propter hoc.* In this connection the following example, cited by Trousseau and Pidoux,[1] is very instructive. Chomel, wishing to test the antimalarial properties of powdered holly (ilex), chose twenty-two patients suffering from intermittent fever, but before making them take the powder in question he submitted them to expectant treatment. Nineteen recovered spontaneously; of the three others one had a quartan, and the other two a quotidian fever. The powdered holly was administered without success to these three patients, who were easily cured with quinin. If Chomel had given the powdered holly to his twenty-two patients at the beginning, the natural conclusion would have been that this powder cured the fever in nineteen of the twenty-two cases.

In this way it is possible to explain how such agents as sodium chlorid, plantain, parsley, artichoke, spiders' webs, etc., have yielded such splendid results to the physicians who did not conduct their experiments with the care exercised by Chomel, and we can understand how the number of substances that have been proposed as substitutes for quinin has become so large. Their popularity, it is true, is only temporary, and experience soon demonstrates in almost every case the absence of those antimalarial properties which have been attributed to them.

Even supposing that it had been shown by numerous examples that a certain drug was capable of curing the types of intermittent fever met with in a given climate, it would still remain to be seen whether this drug would, like quinin, also prove efficacious in the grave forms of malarial fever in hot countries. This, however, is an experiment that cannot justifiably be made, unless we already have certain proofs that the drug to be experimented with has antimalarial properties comparable with those of quinin.

We are acquainted to-day with the parasites that give rise to the phenomena of paludism; we can, therefore, place ourselves under more strict conditions than was formerly possible in making our experiments with drugs in this disease. It will be necessary to demonstrate the presence of the parasites in the subjects chosen for the experiment, and to note the forms under which they present themselves—(1) Before commencing treatment; (2) During the course of treatment; (3) When the treatment appears to be finished.

Among the proposed substitutes for quinin the first place belongs to the other alkaloids extracted from cinchona. Cinchonin sulphate and cinchonidin sulphate, which are less expensive than quinin sulphate, have often been experimented with.

[1] *Traité de Thérap.* 8e édit., tome ii. p. 548.

*Cinchonin.*—Cinchonin is found in the mother-liquor which has served for the preparation of quinin. Its chemic formula differs from that of quinin in that it contains one atom less of oxygen. The salt of cinchonin most usually employed is the sulphate, which is soluble in the proportion of 1 part to 65.5 parts of water. Briquet held that cinchonin is only half as poisonous as quinin. Bochefontaine and Laborde have shown that cinchonin is much more liable to produce convulsions than quinin. In doses of from 75 centigrams to 1 gram (gr. xij–xv) injected hypodermically into a dog weighing twelve kilograms, cinchonin gives rise to epileptiform convulsions. A dose of from 60 centigrams to 1 gram (gr. ix–xv) can produce unpleasant effects in the healthy individual—frontal headache, a feeling of constriction around the temples, pain in the precordial region, and a slowing of the pulse.

Cinchonin sulphate has been used successfully in the simple forms of intermittent fever, but its efficacy in the treatment of paludism is not to be compared with that of quinin.[1] This has been proved by experiments made in the military hospitals of Algiers and of Rome by L. Laveran, Goze, Wahu, Barby, Rouis, Folie-Desjardins, Vital, Maignen, Mayer, and Michel Lévy.[2]

At Blidah 88 patients subjected to expectant treatment had 235 paroxysms, an average of 2.58 each; 56 treated with quinin sulphate had 50 paroxysms, an average of 0.9 each. With cinchonin sulphate the average number of paroxysms was 2.45, or almost as many as occurred with expectant treatment, pure and simple. "The action of cinchonin sulphate appeared to me to be less efficacious in direct proportion to the recency and intensity of the infection. During the epidemic season its lack of efficacy was clear from simple observation, and was all the more striking because I abstained from giving it in the serious paroxysms when a pernicious character of the fever seemed to be imminent."[3]

Briquet[4] recognizes the fact that cinchonin sulphate cannot take the place of quinin sulphate in the treatment of malarial fevers of hot countries, but he thinks that this salt can be used in the treatment of similar fevers in France. The following are the rules that he outlines for its employment:

(1) Cinchonin sulphate should be administered in solution, or if given in powder it should be taken immediately after the ingestion of a glass of some acidulated beverage.

(2) It should always be given in divided doses, one every hour until five or six doses have been taken.

(3) Between the last dose and the paroxysm next expected an interval of from eight to twelve hours should be allowed to elapse.

[1] Montard-Martin: *Mémoire sur la valeur du Sulphate de Cinchonine dans la traitement des Fièvres intermittentes*, 1860, *Mém. de l'Académie de Médecine*, tome xxiv. p. 447. Discussion sur le Sulphate de Cinchonine, *Bull. de l'Académie de Médecine*, tome xxv. p. 565. Delioux de Savignac: art. "Cinchonine" in *Diction. Encyclop. des Sciences médicales.* Laborde: *Bull. Acad. de Méd.*, 1880. J. Simon: *Les Succédanés en Thérapeutique*, Thèse de Paris, 1883.

[2] *Rec. de Mém. de Méd. militaire*, 1859, 3e série, tome ii.

[3] L. Laveran: *Gaz. méd. de Paris*, 1856.

[4] Acad. de Méd., 1er Oct., 1872.

Montard-Martin, who experimented with cinchonin sulphate, arrived at the following conclusions:

(1) Cinchonin sulphate administered in intermittent fever has an action which is incontestable but variable.

(2) Sometimes its action is rapid, and it breaks up the attack like quinin sulphate, but at other times it acts slowly, no matter in what doses it is administered, and the paroxysms disappear only gradually.

(3) The dose of cinchonin sulphate ought always to be greater by at least one-third than that of quinin sulphate employed under similar circumstances.

(4) To obtain a curative action with cinchonin sulphate a dose that varies with the individual from 60 centigrams to 1 gram (gr. ix–xv) must be employed.

(5) Given in this dose cinchonin often produces certain physiologic effects beyond which point it would not be wise to carry it.

(6) The therapeutic action of cinchonin sulphate is not proportional to its physiologic effects; for it cures sometimes without any perception on the part of the patient of its action, while at other times when the physiologic action is marked the therapeutic effect is lacking.

(7) Cinchonin sulphate cannot take the place of quinin sulphate in the treatment of the serious types of intermittent fever.

(8) Cinchonin sulphate may at times be an admirable adjuvant to quinin sulphate in completing a cure that has been commenced by the use of one or two doses of the latter. This procedure will ensure the certainty of recovery with a minimum of expense.

The conclusions of Montard-Martin are more favorable to cinchonin sulphate than those of the physicians who observed its action in Algeria. This can be easily explained by the fact that the types of fever observed in the hospitals of Paris, where the researches of Montard-Martin were made, are much less grave and much less obstinate as a general rule than those met with in Algeria.

*Cinchonidin.*—Cinchonidin is isomeric with cinchonin, and is much less liable to cause convulsions (Bochefontaine). The sulphate is soluble in the proportion of 1 part to 130 parts of water. The majority of observers agree in recognizing the fact that in the treatment of the mild forms of malarial fever cinchonidin sulphate can be successfully employed, but as this salt is less active against malarial infections than quinin sulphate, and as it is at the same time more toxic, it would be dangerous to prescribe in the grave types of fever the large doses of cinchonidin that would be required.

J. Marty,[1] who has carefully studied the properties of the salts of cinchonidin, has arrived at the following conclusions: "To cinchonidin sulphate," he writes, "two objections are to be made—(1) the extreme variability of its action upon the healthy and upon the sick; (2) the facility with which it can provoke the phenomena of intoxication when given in doses that would often appear to be necessary to obtain a proper therapeutic effect. There seems to be no objec-

[1] *Bulletin général de Thérap.*, 1884, p. 355.

tion to the employment of cinchonidin sulphate in the benign forms of malarial fever, more especially in those of tertian type; but in view of the variability of its action it would be imprudent to rely upon it in the graver forms. It should be employed in doses double those of quinin sulphate, but it will be inadvisable to go beyond 2 grams (gr. xxx), or even to reach this dose. This fact is sufficient to completely exclude its use in the pernicious paroxysms and in the serious types of malarial fever. The quantity corresponding to that of quinin sulphate which would be necessary would be sufficient to cause danger."

According to Le Juge de Segrais[1] and De Brun,[2] the salts of cinchonidin are quite as efficacious as the salts of quinin, and possess, besides, the advantage of being better borne by the stomach and of being less likely to cause disturbance of the nervous system. If to this be added the fact that cinchonidin is less expensive than quinin, it would seem necessary to conclude from the works of these observers that cinchonidin ought to be preferred to quinin in the majority of cases—a conclusion evidently too favorable to cinchonidin.

Cinchonidin cannot take the place of quinin in the treatment of the grave types of malarial infection, and one should, generally speaking, prefer quinin in the treatment of paludism. We must, however, recognize the fact that, next to quinin, cinchonidin is the most active alkaloid of cinchona. It may be employed in the treatment of the simple forms of malarial fever; and in the case of certain patients who cannot tolerate quinin, cinchonidin may often be prescribed in preference.

*Quinidin.*—Isomeric with quinin, quinidin appears to be a modification of this alkaloid in consequence of some action that takes place under the influence of light. It is found in the mother-liquor that has served for the manufacture of quinin sulphate. Quinidin, like cinchonin, causes convulsions. In the healthy individual it produces more readily than quinin nausea and vomiting (Gubler), and as its efficacy against malarial infection is less marked than that of quinin one can easily see that the latter is much to be preferred.

*Quinoidin.*—According to Pasteur this substance is not a separate alkaloid, but a mixture of cinchonin, cinchonidin, quinin, and quinidin in variable proportions. It is in fact a product of variable composition, and is far inferior to quinin.

The substitutes for quinin that are not alkaloids of cinchona are either mineral or vegetable substances. Among the principal products of mineral origin that have been recommended in the treatment of paludism may be cited arsenous acid and arsenical compounds, iodin, the alkaline sulphites, copper sulphate, potassium nitrate, sodium chlorid, alum, carbolic acid, picric acid, ammonium picrate or ammonium carbazotate, phenocoll hydrochlorate, potassium bromid, antipyrin, and methylene-blue.

Among the vegetable substances are included willow-bark (Salix alba), and salicin, which is extracted from it; oak-bark; horse-chestnut bark (Æsculus

[1] Le Juge de Segrais: "Étude sur la Cinchonidine et ses Sels comme Succédanés de la Quinine," *Arch. gén. de Méd.*, 1886, tome ii. pp. 420, 693.

[2] De Brun: *Revue de Médecine*, 10 Sept., 1890. Morizot: Thèse de Montpellier, 1893.

hippocastanum); the bark of the poplar (Populus alba, Populus tremula); powdered holly (Ilex aquifolium); cascarilla-bark; the wood of Quassia amara and of Quassia simaruba; alkekenge (Solanum vesicarium or Physalis alkekengi), recommended by Gendron; European or yellow gentian (Gentiana lutea); European centaury (Gentiana centaurium[1]); wild chicory (Cichorum intybus); the leaves and stems of the artichoke (Cynara scolymus); the avens (Geum urbanum); parsley (Apium petroselinum), the seeds of parsley, recommended by Joret and Homolle; apiol, a principle extracted from parsley by Joret and Homolle; plantain (Plantago major); the sunflower (Helianthus annuus), given in the form of the tincture; pambotano (a shrub indigenous to Mexico); eucalyptus and the oxygenated essence of eucalyptus or eucalyptol; berberis and berberin, which is extracted from it; bebeerin (which must not be confounded with berberin; bebeerin is extracted from a wood known in Guiana under the name of bebeeru, a tree belonging to the family of the Laurineæ); pepper, and piperin, the active principle extracted from it; nux vomica, and strychnin.

Of these materials we shall of course only speak of those that are still sometimes employed in the treatment of paludism. In the first place it is to be remarked that among the substances of vegetable origin recommended many are bitter tonics or stimulants of the alimentary canal, as for example Quassia amara and simaruba, European centaury and nux vomica. After what has been said about the influence of tonic medication in the treatment of paludism it is easy to explain the mode of action of these substances. Undoubtedly they can render service in the treatment of paludism, but none of them should be designated a substitute for quinin. The same holds good of arsenous acid, which, when administered in small doses, is a very useful adjuvant to quinin for the anemia and cachexia that follow malarial infection, but it is of no use in the relief of the acute symptoms of paludism.

Boudin,[2] who recommended the treatment of paludism with arsenic, recognized that the mere substitution of this drug for quinin sulphate was not satisfactory. "Our method of treatment," he says, "does not consist in the simple substitution of arsenical preparations for quinin, but rather in a complex medication, in which arsenic is assisted by two powerful means, emetics and a liberal diet. The emetics relieve the gastric disturbance and hasten the return of the appetite. The generous diet shortens the period of convalescence, combats the tendency to relapses and to the numerous sequelæ which are so apt to accompany impoverishment of the blood."

The following are the rules laid down by Boudin: (1) At the beginning of the treatment cause the patient to vomit; (2) Give arsenic in divided doses, so that the last is taken at least two hours before the paroxysm that we wish to control; (3) Profit by the tolerance that exists at the beginning to administer the largest dose of arsenic, and continue the administration in gradually diminishing doses as the degree of tolerance becomes less; (4) Exhibit the med-

[1] The blessed thistle (Centaurea benedicta), and the star-thistle (Centaurea calcitrapa).

[2] Boudin: *Traité de Géogr. et de Statist. méd.*

icament during the intervals of apyrexia, as well as upon the days on which the fever occurs; (5) Continue the treatment for a period proportionate to the length of time during which the disease has existed; (6) Make use of a substantial and very abundant diet and give a generous wine, etc. Boudin used an aqueous solution of arsenous acid (1 : 1000) which is still called, after him, Boudin's solution (*liqueur de Boudin*).

As a rule, patients bear well from 3 to 4 centigrams (gr. $\frac{1}{2}$–$\frac{2}{3}$) of arsenous acid in the first few days of the treatment. Boudin has prescribed as much as 10 centigrams (gr. $1\frac{1}{2}$) of arsenous acid in the twenty-four hours. A dose of this size can, however, produce grave symptoms, and the hardihood with which Boudin used arsenous acid ought not to be imitated. After Boudin, a defender of arsenic in the treatment of malarial fever was found in Sistach.[1]

The treatment recommended by Boudin has been completely abandoned. When arsenic is given in large doses for any length of time its use is almost always followed by gastro-intestinal disturbances that are very prejudicial to the continuation of the treatment. The nutrition is interfered with, and it is difficult to understand how Boudin, who understood so well the good results to be obtained from generous alimentation in patients suffering from malarial infection, could advise the employment of arsenous acid in such large doses.

To sum up, the reconstructive action of arsenic administered in small doses and for a long time appears to be incontestable. Its antipyretic action is very doubtful. No conscientious physician would be willing to make trial of Boudin's treatment in the graver forms of paludism.

It is only natural that sulphur and iodin, metals akin to arsenic, and which, like it, are very energetic parasiticides, should have attracted the attention of experimenters. Polli,[2] having demonstrated that the antiputrefactive properties of sulphurous acid are possessed by the alkaline or earthy sulphites, concluded that the sulphites were indicated in zymotic diseases, and notably in malarial infections. The treatment of malarial fever with the sulphites, however, does not appear to have been satisfactory, and the results reported by Polli himself are not at all convincing.[3]

The treatment of intermittent fever with iodin has been recommended several times, more especially by Boinet,[4] by F. de Willebrand,[5] Professor at the University of Helsingfors; by Barilleau and Seguin, and by several Italian physicians, Gualdi, Cantani, Regnoli, L. Concetti.[6]

The formula employed by Willebrand is as follows:

| | |
|---|---|
| Iodin, | 1. (gr. xv); |
| Potassium iodid, | 2. (gr. xxx); |
| Distilled water, | 10. (f℥iiss).—M. |

S. Five drops of the solution to be taken every two hours in half a glass of water.

[1] *Rec. de Mém. de Méd. milit.*, 1861, 3e série, tome v; and *Arch. gén. de Méd.*, 1875.

[2] Polli: *Sulle Malattie da fermento morbifico*, Milan, 1864.

[3] C. Paul: *Bullet. gén. de Thérap.*, 1865, tome lxix. L. Collin: *Traité des Fièvres intermittentes*, p. 402.

[4] *Traité d'Iodothérapie.*

[5] *Arch. gén. de Méd.*, 1869, tome ii. p. 46.

[6] *Gazz. degli Ospitali*, 1883, No. 58, p. 459.

L. Concetti recommends from 24 to 36 drops of tincture of iodin in 60. (f℥ij) of distilled water, to be taken in three doses before the paroxysm.

The action exerted by iodin appears to be a tonic one analogous to that of arsenic. The treatment with iodin, like that with arsenic, is not applicable to recent cases of fever, nor in the grave types. Iodin is only absorbed in the form of the alkaline iodids, and can only be given in small doses. It will be readily understood, therefore, that it does not destroy the hematozoa of paludism as it does the infusoria in water.

Strychnin and nux vomica, recommended more especially by Pearson-Nash,[1] ought to be ranked, together with arsenic, among the drugs that, thanks to their tonic properties, are of service in the treatment of obstinate malarial fevers and of the malarial cachexia, but the antipyretic properties of which are very problematic. Binz recommended bebeerin, an alkaloid extracted from the bark of Nectandra Rodiei (Laurineæ). This substance has properties analogous to those of quinin, and like it, rapidly destroys the infusoria.

Piperin, in doses of from 50 to 75 centigrams (gr. viij–xij), and bebeerin sulphate in doses of from 25 to 75 centigrams (gr. iv–xij), according to Griesinger, are the least objectionable of the proposed substitutes for quinin. Experience, however, does not appear to have justified this opinion of Griesinger; for piperin and bebeerin are to-day no longer employed.

Of late years many Russian and German physicians have recommended alum in the treatment of paludism.[2] The antipyretic properties of this drug have not been more clearly demonstrated than those of sodium chlorid, of copper sulphate, and of potassium nitrate.[3]

Carbolic acid has been employed hypodermically by Dieulafoy,[4] who injected daily for fifteen or twenty days from 3 to 5 cubic centimeters (ℳxlv–lxxv) of a 1 per cent. solution; that is to say, from 3 to 5 centigrams (gr. ½–¾) of carbolic acid. This treatment did not produce local phenomena, and in one case cited by Dieulafoy the fever yielded, not indeed suddenly, but gradually, contrary to what took place when quinin was employed.

Phenocoll hydrochlorate (from 1 to 1½ grams—gr. xv–xxiij, in two or three doses), the tincture of eucalyptus, and the tincture of helianthus, are very uncertain antipyretics. Phenocoll hydrochlorate has been experimented with by Cervello[5] in Palermo, and by G. de Angelis and Livio Vincenzi.[6]

The cultivation of the eucalyptus-tree has given excellent results in malarial districts, and many localities in Algeria, in Corsica, and in Italy have been rendered healthy by means of these plantations. From this fact it was concluded that the eucalyptus contained substances capable of destroying the parasites of paludism, and from the leaves or from the bark of the eucalyptus

[1] *Lancet*, London, 1867.

[2] "On the Treatment of Intermittent Fever with Calcined Alum," *Deutsche med. Wochenschrift*, 1885, and *Bull. gén. de Thérap.*, 1885, p. 229.

[3] Hunter on "The Employment of the Nitrate of Potassium in the Treatment of Paludism," *North Carolina Med. Jour.*, 1890. Abstract in *Médecine Moderne*, December 4, 1890.

[4] *Bull. de la Soc. méd. des Hôpitaux*, 1884.

[5] *Semaine médicale*, 1893, p. 2.

[6] *Riforma medica*, 1893.

various products have been prepared and tried in the treatment of malarial fever. Tristani, Brunel, Castan, and Gubler obtained with them some success, but other observers, and by far the greater number, administered them without good results, even in cases of simple intermittent fever, and as a matter of fact eucalyptus is to-day no longer employed in the treatment of paludism. The tincture of eucalyptus was exhibited in doses averaging 4 grams (f℥j) in the twenty-four hours. The oxygenated essence of the Eucalyptus globulus, called eucalyptol, exerts upon the economy an action very similar to that of turpentine. This essence possesses antifermentative and antiputrefactive properties.

The failure of the preparations of eucalyptus in the treatment of paludism proves in no way the futility of the plantations of these trees in malarial districts. It is very probable that the eucalyptus, of which the growth is remarkably rapid, acts simply by draining and drying the soil, and in fact produces the same effect as any other plant, only more quickly on account of the rapidity of its development.

Romanowsky,[1] who experimented with the tincture of helianthus, could not see that the parasites of paludism disappeared from the blood under the influence of this drug, of which the antimalarial properties seemed to him not to have been proved.

Potassium bromid and antipyrin might possibly fulfil certain indications in the treatment of malarial fever. Antipyrin, for instance, might be used to moderate the fever and the headache, but neither can be considered more than an adjuvant to quinin.

Methylene-blue or methylcyanin is the latest of the proposed substitutes for quinin. Methylene-blue, it is true, stains the hematozoa of paludism, and relying on this fact, Ehrlich and P. Guttmann [2] tried the effect of this product in the treatment of paludism. In the first paper that they published on this subject, only two cases of recovery from intermittent fever under this treatment are quoted. Since that time they have published five other cases, seven recoveries in all—a very small number, considering that the intermittent fever often disappears without recourse to specific medication. In order to guard against relapses, methylene-blue should be given for four weeks. During the first week 50 centigrams (gr. viiss) (five capsules of 1 decigram—gr. iss each) are given daily. During the following weeks 30 centigrams (gr. ivss) are given in the twenty-four hours (Guttmann).

Boinet and Trintignan [3] obtained favorable results in recent cases of malarial fever by giving from 60 centigrams to 1 gram (gr. ix–xv) of methylene-blue daily. Bourdillon [4] and Thayer [5] cite also some cases of cure of intermittent fever following the administration of methylene-blue. Other observers have been less fortunate. G. Mya,[6] who employed methylene-blue hypodermically, states that the injections caused a good deal of pain, and that the action upon

[1] *Vratch*, 1891.

[2] *Berliner klinische Wochenschrift*, 1891.

[3] *Bull. méd.*, 5 Juin, 1892.

[4] *Revue de Médecine*, 10 Septembre, 1892. *Bull. méd.*, 15 Juin, 1892.

[5] *Bulletin of the Johns Hopkins Hospital*, May, 1892.

[6] *Méd. moderne*, 1892, p. 208.

the course of the fever was not very marked. Senator and Strassmann[1] obtained no good results from the treatment of malarial fever with methylene-blue.

For my part I have on several occasions prescribed methylene-blue for patients suffering from intermittent fever, without success, and I have assured myself that it is impossible in this way to color the hematozoa of paludism in the blood-vessels of man, any more than the hematozoa in the vessels of birds. In the case of birds that were experimented upon, methylene-blue when injected under the skin in large doses finally stained the nuclei of a certain number of the blood-corpuscles, but death took place before it was possible to stain the hematozoa.[2]

Methylene-blue, administered in doses of from 40 to 50 centigrams (gr. vj–viiss) daily, exercises a marked effect upon the color of the urine, which takes on at first a greenish tinge, and then a deep blue. When the use of methylene-blue has been prolonged, or when large doses are given, dysuria is observed. The feces also are colored in the same way. If methylene-blue be used a very pure product should be employed.

To sum up, in spite of the large number of substances that have been proposed as substitutes for quinin, it is safe to say that we are acquainted with no drug that is really deserving of the title, and which in a grave case of malarial fever can inspire the same degree of confidence as quinin. It is to quinin, then, that we must always have recourse in the treatment of acute malarial infection when we wish to break up an intermittent fever, and still more when we are dealing with the graver types.

The only objection that can be urged against quinin is that it is somewhat expensive, but it seems to me that too much is made of this fact. Quinin sulphate costs in France to-day only fifty-four francs ($10.80) per kilogram (2.2 lbs.), or about six centimes (1¼ cents) per gram (gr. xv).[3] Drugs that are far more expensive and far less useful are prescribed every day. It is to be hoped, also, that the cultivation of cinchona will be extended to every country in which this is possible, and that the price of the drug will continue to diminish. Already the prosecution of this industry in the East Indies, Ceylon, Java, and Mauritius has been attended with very gratifying results.

5. **The Employment of Quinin as a Prophylactic in Malarial Regions.**—We should exceed the scope of this article if we treated here of the general prophylaxis against paludism, and of the different methods of rendering the soil healthy by cultivation and drainage, but we think it right to devote a few lines to prophylaxis on the part of the individual, and in particular to the employment of quinin as a prophylactic.

The most important advice to be given to a person who is called upon to live in a malarial district is to choose with care the situation of his house, and to profit by the influence of altitude, which is not less favorable than remark-

[1] *Berliner med. Gesellschaft*, 1893. *Union méd.*, 1893, p. 418.

[2] *Soc. de Biologie*, 30 Janvier, 1892.

[3] In the United States the wholesale price of quinin is about 30 cents an ounce.

able. The degree of altitude sufficient to preserve the inhabitants against paludism is inconsiderable. In the same city one often finds quarters that are very healthy quite close to portions that are notoriously unhealthy. The highest parts of a town, and the most central and most thickly populated streets, afford a maximum of protection. On the contrary, the dwellings situated in the low-lying parts, on the marshy grounds near streams, and those that stand alone in the country, more especially if there are marshes or irrigated lands in the neighborhood, should be avoided. In all hot and unhealthy countries it has been the custom, as is done in India, to build on the high ground sanatoria, in which the inhabitants pass the season during which the fever prevails.

The traveller and the soldier who are obliged to pass through marshy localities, and sometimes to remain there, during the endemo-epidemic season should carefully choose their camping-places, which should be established not on the banks of rivers nor in the valleys, but as far as possible on high ground.

During the endemo-epidemic season one should avoid passing through regions where paludism is especially prevalent, and, above all, one should not spend the night in such places. Laborers or harvesters, who are obliged to work in unhealthy localities, should repair in the evening to dwellings built upon high ground. Sailors will find an excellent retreat by keeping to their vessels.

The drinking-water in malarial districts, more particularly during the endemo-epidemic season, should be the object of scrupulous attention. Unless it is quite certain that the water comes from sources free from paludism, it should not be used for drinking without carefully filtering; or, better still, it should be boiled.

All debilitating factors favor malarial infection. During the endemo-epidemic season, therefore, too great fatigue and excesses of all kinds should be avoided. Good food should be supplied; alcoholic beverages, so dangerous in hot countries when they are abused, are useful in small doses to combat the debilitating effects of the heat, and the same may be said of spices and of condiments, the use of which is rendered necessary by the atony of the alimentary tract, but which, when taken in excess, become deleterious.

Coffee, on account of its tonic properties, is an excellent beverage in hot countries, and it is for this reason that the people of the East use it largely. Infusions of coffee and tea, besides, have the advantage that the water used in their preparation must be boiled, and in consequence is rendered sterile.

Persons who have already had one or more attacks of malarial fever ought to redouble their precautions in order to avoid relapses, which are always to be feared, especially if there is persistent anemia. Such persons should have recourse to quinin on the slightest symptoms of a return.

It is not always possible to observe the directions just laid down. Many persons are obliged to pass through, or even to live in, very unhealthy regions during the fever-season.

The utility of a preventive treatment of paludism becomes manifest when one resides in a locality where malarial fever prevails with such virulence that

there is very little chance of immunity, and where the most insidious and the most serious forms prevail.

Numerous facts show that cinchona and the salts of quinin that cure paludism are also capable of preventing its occurrence. In the English navy it is frequently the custom to use the wine of cinchona and quinin sulphate as prophylactics. Every time that men are landed in tropical regions they are made to take, in the morning just before leaving the ship and in the evening when they return, some wine of cinchona. To demonstrate the wholesome effect of this practice, Bryson[1] quotes the following facts: "Twenty sailors and one officer were sent to Sierra Leone to work during the day. To the sailors was administered some cinchona-bark. The officer refused to take any, and he was the only person who had the fever. Later on two cutters were detached from the *Hydra* to explore the river Sherbo. They were absent a fortnight. Every day the men took cinchona in wine, in accordance with the instructions that had been given. Not a single one was attacked by the fever, although the region explored was reputed one of the most unhealthy on the coast. The crew of a third cutter stayed for two days only in the same region and at the same time; the men took no quinin; all were attacked, with the exception of the officer who was in command of the cutter."

On Bryson's recommendation, quinin sulphate has been substituted for powdered cinchona at the stations on the coast of Africa. A strong alcoholic solution of quinin sulphate is poured into several barrels of wine, so that about 30 c.cm. (f℥j) of wine contain about 25 centigrams (gr. iv) of quinin sulphate. The reports of the surgeons of the Royal Navy of England are, as a rule, in favor of this method of procedure.

Quinin and cinchonin were employed as prophylactics during the War of the Rebellion whenever the troops were called upon to occupy malarial posts. The reports of the American army surgeons are almost all in favor of this form of medication.[2] Chamberlain, Wilson, David Merrit, Maylert and Bache, Swift, and Thompson all agree as to the good effects of quinin in the prevention of malarial fever.

Warren gave to 200 men of his regiment during the fever-season, 30 centigrams (gr. v) of quinin sulphate daily. Among these there occurred only four cases of malarial fever; while among the rest of the regiment (about 400 men) who were not submitted to this preventive medication, there were more than 300 cases of the disease.

Samuel Logan made a certain number of men in his regiment, while on service in South Carolina during the summer of 1863, take daily 25 centigrams (gr. iv) of quinin, and notes the following results: Of the men who did not take quinin 58 per cent. were attacked; of those who took it irreg-

[1] Van Buren: *Reports to the Sanitary Commission of the United States. Essais d'Hygiène et de Thérap. milit.*, by Evans, 1865.

[2] *The Medical and Surgical History of the War of the Rebellion*, 1888, vol. i. p. 111–116. Longuet: "La Prophylaxie de la Fièvre intermittente par la Quinine," *Semaine médicale*, 1891, p. 5.

ularly 39 per cent. were seized, and of those who took it regularly 19 per cent. suffered.

Jilek of Pola cites the following facts: Of 736 soldiers lodged in barracks in an unhealthy locality, 500 took daily 1 centigram (gr. $\frac{1}{6}$) of quinin sulphate; of this number 18 were attacked by the fever; while of those who took no quinin 28 per cent. were attacked. Hertz[1] of Amsterdam observed analogous results: "On the West Coast of Africa the officers of the *Penelope* made an excursion up a river surrounded by marshes. All but one observed the precaution of taking some quinin sulphate, and this man was eight days afterward attacked with a violent paroxysm of bilious intermittent fever."

Thorel[2] was able to traverse the most unhealthy regions of Mekong without suffering from malarial fever, thanks to quinin sulphate taken in doses of from 60 to 80 centigrams (gr. ix–xij) in the week. Those of his companions who took the same precautions also escaped malarial infection.

Bizardel states additional examples of the efficacy of quinin as a prophylactic against paludism. With the small doses of quinin recommended by Bizardel one could scarcely hope to entirely prevent malarial infection, but it is at any rate a great thing to prevent paludism from manifesting itself in its most serious forms. Bizardel[3] on several occasions mentions the fact that even in the most unhealthy regions individuals who took quinin in prophylactic doses never showed symptoms of the pernicious types of the fever. As a matter of fact these are the very accidents to be feared by men who are isolated and who cannot immediately receive treatment from a physician.

Groeser,[4] who tested the prophylactic value of quinin at Batavia, one of the most unhealthy regions of the globe, arrives at favorable conclusions. The attacks of fever are much less frequent and much less serious among the sailors who, when they enter this dangerous port, submit to treatment with quinin, than among those who neglect this prophylactic measure. The use of quinin as a prophylactic against malarial fever has also been recommended by Nicolas.[5]

Sézary[6] was in the habit of prescribing quinin in Algeria to prevent malarial fever among individuals who inhabited very unhealthy localities, and obtained with it excellent results. "In the most unhealthy regions of Algeria—so unhealthy, in fact, that colonization is rendered impossible or at least exceedingly dangerous—the daily use of small doses of quinin, about 15 centigrams (gr. ij), is sufficient to prevent the appearance of paroxysms of fever, and to keep the inhabitants in a state of perfect health. The remedy should be continued as long as the fever rages in these regions, which is gen-

[1] Gestin, quoted by Fonssagrives: *Hygiène navale*, p. 224.

[2] Thorel: Thèse de Paris, 1870.

[3] Bizardel: *De la Quinine comme Prophylactique du Paludisme*, Thèse de Paris, 1888.

[4] Groeser: *Berliner klinische Wochenschrift*, 1888, No. 42, p. 845; 1889, No. 53, p. 1065.

[5] Nicolas: *Chantiers et Terrassements en Pays paludéens*, Paris, 1888.

[6] Sézary: *Revue de Thérapie medico-chirurgicale*, 1892, and *Médecine moderne*, 1892. *Congrès de Besançon pour l'Avancement des Sciences*, 1893.

erally from July 1st to September 1st. It is probable that the same prophylactic treatment, if applied to laborers engaged in public works, would render them immune to malaria. In any case it is worthy of trial, and this method ought to be experimented with by the physicians who are connected with these undertakings."

In the expedition to Dahomey, Barthélemy prescribed quinin as a prophylactic with much success. The Europeans in charge of the native troops participated in the whole campaign, and not a single one of the petty officers, who took daily from 10 to 20 centigrams (gr. iss–iij) of quinin, was attacked by malarial fever.

Arsenic has been employed in Italy as a prophylactic against paludism. The experiments have been made on several occasions on workmen and railroad employés and in the army. Tommasi-Crudeli[1] claims to have obtained favorable results from this treatment. In 1883 and 1884 experiments were made in Venice upon men belonging to the second punishment-corps, who had consented to submit to it. The arsenic was taken in the form of arsenical gelatin; the dose of arsenous acid was gradually raised from 1 to 8 milligrams (gr. $\frac{1}{60}$–$\frac{1}{8}$), and this dose was kept up unless gastro-intestinal symptoms appeared, in which case the treatment was suspended. In 1883 and 1884, 100 soldiers who had never had malarial fever, and who were placed under the same conditions, took part in the experiment. Among 50 soldiers who were subjected to the prophylactic treatment with arsenous acid there were 14 cases of malarial fever. Among 50 others not subjected to treatment there were 19 cases. The difference between these numbers is too slight and the chances of error too numerous (it being impossible to admit that the conditions were exactly the same for every man who was subjected to the treatment) to make it possible to draw a conclusion favorable to the use of arsenous acid as a prophylactic against malaria.[2]

[1] *Report to the Minister of Agriculture*, Rome, March 18, 1893.

[2] *Gior. med. d. r. esercito*, Roma, 1886, xxxiv. pp. 42–65.

# MALARIAL HEMATURIA.

By JOHN L. DAWSON, JR.

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Malarial hematuria may exist in three forms: First, as a free hemorrhage from any portion of the genito-urinary tract in the hemorrhagic type of pernicious malarial fever; secondly, it may occur concurrently with passive renal hyperemia due to an acute malarial paroxysm; or, thirdly, it may be present in malarial cachexia as hemoglobinuria.

The treatment of these three forms may vary somewhat as to detail, but our first effort should be to bring the patient as rapidly as possible under the influence of quinin in some form, so as to control the destructive power of the malarial germ, thereby holding the cause of the hemorrhage in abeyance, if not able to remove it completely at once. That the alkaloids of cinchona are specifics in the treatment of diseases due to the malarial germ is an axiom that should never be lost sight of in any attempt to combat symptoms or lesions due to the malarial organism, and therefore our first and only effort for the time being should be to cinchonize the patient as rapidly as possible. We may use any method in our power to introduce the drug into the system—by hypodermic means if pernicious symptoms be present, or by absorption from the stomach or rectum, or even by epidermic or endermic methods should the symptoms be less acute and less formidable. Any of these methods will be useful at times, and the choice will depend upon the intensity of the dose of the malarial poison, irritability of the stomach, or the gravity of the case.

**Treatment of Free Renal Hemorrhage in the Hemorrhagic Type of Pernicious Malarial Fever.**—We have not time for slow absorption of quinin in pernicious malarial hematuria, and therefore the hypodermic method of introducing the drug should be resorted to at once, without first trying absorption through the stomach. There is a great choice in the salts of quinin for hypodermic use, on account of the greater solubility of some over others. The best, when obtainable, is the dihydrochlorate. The following well-known formula is perhaps as good as any:

| | | |
|---|---|---|
| ℞. | Quininæ hydrochloratis, | ℈j (1.3); |
| | Acidi hydrochlorici, | ♏v (0.31); |
| | Aquæ destillatæ, | ♏xv (0.92).—M. |

Every minim (0.06) of this solution represents 1 grain (0.065) of quinin hydrochlorate.

Should we be unable to procure the hydrochlorate, we could use the ordinary sulphate, rendered soluble by the addition of the smallest possible amount of sulphuric acid. The objection to this is the irritant action of the drug, resulting nearly always in abscess-formation; but this should not deter us in severe cases, as we cannot afford to lose time. Having obtained a solution, we should inject a sufficient quantity of the drug—not less than 10 grains (0.65) to begin with—deeply into some suitable part, the buttock preferably. Should more than one syringeful be required to obtain the necessary dose, multiple punctures should be made with the hypodermic needle, for more than the quantity named should not be injected in the same spot. As soon as an amelioration of the symptoms becomes evident the dose should be curtailed, and the effects of the drug be maintained by administration by the mouth until the existing paroxysm be completely controlled.

Occasionally we meet with dangerous and profuse hemorrhage from all mucous surfaces, and blood-extravasations into the subcutaneous cellular tissue. So violent are these cases that death rapidly ensues before absorption of a sufficient quantity of quinin to control the poison can be effected by the subcutaneous method. Baccelli suggested the idea of introducing the drug directly into the circulation in such cases, thereby theoretically bringing it in direct contact with the malarial germ. He suggested and practised the intravenous injection of a neutral solution of quinin hydrochlorate into a vein of the forearm: 16 grains (1.) of quinin hydrochlorate were dissolved in 1 dram (4.) of a normal salt-solution, and strictly aseptic precautions were observed. The results have been brilliant, and with ordinary care the operation has been harmless, save for pronounced symptoms of quinin-intoxication. I would not hesitate to advise this method in pernicious malarial hematuria of malignant type. Having cinchonized the patient and controlled the paroxysm, our next effort should be to control the hemorrhage from the kidneys by the use of styptics. The best of these are iron and ergot, and they should be exhibited in large doses in combination with digitalis, which acts both as a cardiac stimulant and as a diuretic. The tincture of ferric chlorid and the fluid extract of ergot, with a fresh infusion of digitalis-leaves, make the best combination of these drugs. Gallic acid also acts well in some cases, especially when combined with large quantities of fluid. Having overcome the paroxysm and controlled the hemorrhage, we must, if possible, prevent a return by keeping the patient cinchonized.

**The Treatment of Hematuria due to Passive Renal Hyperemia, a Complication of Acute Malarial Intoxication.**—In these cases, as in the former, quinin is our sheet-anchor. Rapid cinchonism produced by any method should be our first aim. As these cases are less violent in onset and do not threaten with impending death, we have more time for action, and the rather heroic administration of quinin recommended in the pernicious type of the disease should give place to gastric and rectal absorption. When given by the mouth, the readiest effects are produced by the drug in solution. Should the stomach be too irritable, or oral administration be prevented by any cause,

we should have recourse to rectal injection. The best method of administering quinin by the rectum is in solution in sour milk, the lactic acid acting as a ready solvent. A dram (4.) of quinin sulphate is readily dissolved in ½ pint (250.) of sour milk, and the rectum will hold this comfortably. This means of administering the drug has yielded the happiest results in my hands, and can be recommended highly.

Having combated the plasmodium by means of free cinchonism, the next step should be to relieve the congested kidneys. Local fomentations of digitalis-leaves or simple hot poultices are of value. Leeches or dry cupping of the loins should be resorted to, and the kidneys should be freely flushed. The best diuretic is water, and the patient should be encouraged to drink large quantities of fluid. Any demulcent will answer, or any of the natural mineral waters. The drug that has given the best results is nitroglycerin, and it should be given generously: $\frac{1}{100}$ grain (0.00065), or, better, 1 minim (0.062) of a 1 per cent. alcoholic solution, should be given every two hours until the physiologic effects of the drug become apparent. Having cinchonized the patient and relieved the congested kidneys by these means, we have met every indication, and the prophylaxis should be maintained by steadily combating the plasmodium malariæ.

**The Treatment of Hemoglobinuria the Result of Malarial Cachexia.**—In this condition we have a passage of hemoglobin into the urine because of an existing dyscrasia of the blood due to the slow disintegration of the red blood-cells by small and oft-repeated doses of the malarial poison. The process is a chronic one, and little by little the hemoglobin is lost until the life of the patient is menaced. Profound anemia is the consequence, the blood containing at times as little as one-tenth the normal amount of hemoglobin. Again we should combat the malarial germ with quinin, but, as these cases are chronic, or at best subacute, our treatment should be slow but persistent. Both iron and arsenic should be combined with quinin, the former being of especial value. Manganese dioxid is also of service. The following formula is one that I have often used in these cases, with the happiest results:

| | |
|---|---|
| ℞. Quininæ disulphatis, | gr. j–ij (0.065–0.13); |
| Acidi arseniosi, | gr. $\frac{1}{20}$ (0.0032); |
| Mangani dioxidi, | gr. j (0.065); |
| Strychniæ sulphatis, | gr. $\frac{1}{40}$ (0.0016).—M. |

Make into one pill.

Such a pill taken after meals will produce the desired effects.

In all the forms of malarial hematuria great attention should be paid to the general hygiene of the individual. Concentrated food, easily assimilated, should be given at stated intervals. Baths and frictions should be resorted to during convalescence, and the patient should be removed from a malarial atmosphere to a salubrious climate. Attention to detail and a persistent use of the

remedies suggested should be insisted upon, never losing sight of the fact that the cause must be removed before a successful result can be expected.

I have avoided mentioning the theory, again recently discussed by Italian physicians, that quinin may of itself cause hematuria, and therefore should be employed with caution in malarial cases presenting this symptom. This theory I believe to be wholly groundless, and it certainly is not maintained by American physicians of to-day. I have used quinin in very large doses and have continued its use for a long period, and I have yet to see the first case of hematuria as the result. One must be certain that the malarial germ is the causative factor of an existing hematuria, and then he will be perfectly justified in pushing quinin to its necessary limit.

# INTERNAL ANIMAL PARASITES.

By FREDERICK A. PACKARD.

In this section only the true internal parasites will be considered. The *amœba coli* will be dwelt upon in the section upon Dysentery, while the false parasites—such as the larvæ of different insects and other forms of animal life accidentally introduced—will not be mentioned, owing to the fact that they are in no way therapeutically related to the true parasitic organisms.

## General Considerations in regard to Prophylaxis.

All parasites being derived from similar forms previously existing, it is evident that to guard against them it is essential to prevent access of the adult, larval, embryonal, or oval forms of the individual parasite to the human body. Ordinary hygienic laws, if carried out, would cover all the requirements—in other words, parasitic diseases are pre-eminently preventable—but some words are necessary to particularize the modes of infection that are to be especially avoided.

In some of the parasitic diseases of man, infection takes place directly by the transmission of eggs or adult forms from the primary host—immediate transmission. In others there is required the aid of a third animal body which acts as a host for the parasite during an intermediary stage of its existence—mediate transmission. Immediate transmission but seldom occurs directly from the body of one host to that of another, as usually even in this class the parasite or its young or eggs have dwelt for at least a short time outside of the body of the original host. The nearest approach to direct transference from an infected to a previously healthy person occurs in the case of the oxyuris vermicularis, with which inoculation of a bedfellow by accidental contamination of the fingers with the eggs emitted during the night can readily occur. Generally the eggs are deposited with the feces in some situation where by inoculating food or drink they can be ingested by a second person. Badly placed privy-wells, by allowing access of the eggs to the water used for drink by others, form a ready mode of contamination. Promiscuous defecation in the neighborhood of streams can of course act in the same way. Vegetables contaminated by fecal matter containing eggs or embryos can, in the case of such edibles as are eaten without the previous use of heat, readily produce a new generation of parasites in many individuals. So, also, the wholesale and purposeful employment of human excrement as a means of fertilization is capable of perpetuating indefinitely the different species of parasites. The eggs of parasitic worms are so extremely tenacious of their vitality that it

is surprising that, particularly in the neighborhood of large cities where the truck-farms are manured by human excrement, more cases of parasitism do not occur. The relative rarity, at least in this country, of this class of diseases is evidently due to two causes—comparative cleanliness in the matter of food and drink, and the almost universal practice of thoroughly sterilizing by means of heat all animal and most vegetable foods before they are eaten. Undoubtedly, then, all cases of parasitism in this climate are to be attributed to personal uncleanliness, disregard of the necessity for purity of the ingesta, or the consumption of raw or much-underdone meats. In the matter of personal uncleanliness nothing further need be here said, as the ordinary instincts of man are, if heeded, sufficiently rigorous.

Speaking in general terms it may be said, therefore, that parasitism, so far as we at present know, can be absolutely prevented by proper care in the matter of food and drink. Filtering or boiling water, or, better still, a combination of the two proceedings, will absolutely prevent infection by such parasites as are acquired through contamination of the water by eggs or by such as pass some stage of their existence within the body of minute aquatic animals. According to Cobbold,[1] if water be carefully filtered, infection by parasitic forms that are transported through drinking-water can be entirely prevented. A charcoal filter "will effectually prevent the passage of the ova, since their diameter is nearly $\frac{1}{370}$ of an inch." The thorough washing of such vegetables as are eaten uncooked will minimize the danger from accidental contamination of garden-products. Proper cooking of animal foods will do away with all danger of infection by parasites claiming the food-producing animals as intermediary hosts. The disinfection of excreta by heat would effectually prevent the spread of almost all forms of human parasitism, but this is unfortunately impracticable. Large quantities may, however, be rendered innocuous if sufficient quicklime be added to kill eggs and larvæ by the heat evolved (Sonsino).

Such in general terms are the lines to be pursued in the prevention of infection by animal parasites. More detailed remarks upon preventive treatment will be made in the description of the individual parasites.

For convenience the internal parasites may be divided into two main divisions—those that are merely temporary occupants of the intestinal tract, and those that are permanent intestinal parasites. The former of these divisions can readily be still further divided according to the final seat of the parasites in the body. The permanent intestinal parasites can be divided into many subdivisions, but only the cestodes can be grouped together with advantage in regard to treatment. In what follows some remarks must be made that belong to the domain of etiology rather than to that of treatment, but they are necessary to a complete understanding of prophylactic measures.

### Permanent Intestinal Parasites.

**Coccidia.**—Three forms of coccidia occur in man—C. oviforme, C. perforans, and C. bigeminus. Although these should not all be grouped under the

[1] *Parasites of Man, etc.*, p. 126.

foregoing heading, it is convenient to discuss them together in this place, inasmuch as the prophylactic measures are the same for all.

The coccidium oviforme escapes from the liver of rats, mice, rabbits, and possibly dogs and cats, and, finding its way through the bile-ducts into the intestine, leaves the body with the dejecta. The other two forms also are voided with the feces, but are found in the cells of the intestinal villi instead of in the liver of the humbler hosts. For all forms treatment is purely prophylactic. The manner of infection is probably through the soiling, by the dejecta of lower animals, of lettuce, dandelion-greens, cabbage, or other surface-plants that are eaten in the raw state. Prophylaxis, therefore, consists in the thorough cleansing of all such articles.

There is no known method of treatment for the condition when acquired, even should a diagnosis of the infection be possible.

**Balantidium Coli.**—This is now proved to be identical with the similar organism constantly present in the dung of swine. Voided by the pig, it probably becomes encysted, and in this condition it may long preserve its vitality. The encysted form may be brought directly into contact with articles of man's diet through the manuring of vegetable gardens with the refuse of the sty, or the organism may be carried by wind or rain to such articles or into the source of supply of drinking-water. Having been ingested by man, the encysted form is probably liberated in the stomach or upper bowel. The careful cleansing of vegetables that are eaten without the previous application of heat, and the boiling of drinking-water, will effectually prevent infection.

The statement of Binz that quinin is fatal to unicellular organisms is doubtless true, and Ortmann has found that drug to be the most effective agent in killing the organism when brought into contact with it outside of the body. Quinin may be given in the form of enemata, in the strength of from 1 : 5000 to 1 : 1000, and the author just quoted advises the contemporaneous administration of the same drug by the mouth. It is stated that injections of tannic acid or of vinegar are of benefit. Whatever rectal medicament is chosen, it should be remembered that the parasite is capable of dwelling in any portion of the large intestine, and that the injection should, therefore, be given through the long rectal tube introduced high up into the bowel.

E. Roos[1] records a case of diarrhea due to the balantidium coli and cured by the administration of calomel by the mouth.

The exact significance of the flagellata in connection with human disease is not as yet clear, nor do we know the mode of infection. As it is possible, however, that these organisms may in some cases, particularly in children, stand in an etiologic relation to the diarrhea that they accompany, it is proper to direct treatment toward their destruction. Rectal injections of quinin, from 1 : 5000 to 1 : 1000, or of corrosive sublimate, from 1 : 20,000 to 1 : 5000, should be employed when this relation apparently exists. So far as is at present known, it is probable that the parasites gain access to the body through

[1] *Deutsches Archiv für klinische Medicin*, Bd. li. Hefte 4, 5.

the drinking-water. Care in the choice of supply for drinking-water, and boiling or filtering that used, would probably prevent infection.

**Ankylostomum Duodenale.**—The extraordinary prevalence of this parasite in various portions of the world, the ease with which it is acquired, and the serious consequences of its invasion, render important the thorough understanding of possible preventive measures and their rigorous enforcement.

So far as is now known, this parasite inhabits no host other than man. From its position in the duodenum and upper portion of the jejunum the parasite deposits eggs which are voided in the feces. In the segmented egg, when placed under favorable conditions, the embryo in twenty-four hours or more develops and escapes. The favoring conditions are the presence of moist earth and protection from the direct rays of the sun. The larva so environed can live for weeks or even months. In countries in which this parasite is found the disease is prevalent among miners, brickmakers, workers on plantations, and in other classes of laborers working in damp earth.

The manner of infection is by direct transference of the larva to the stomach through contamination of the hands, of the food, or of the drinking-water. The hands may readily convey the minute parasite either by direct transference to the mouth or through contamination, by the soiled hands, of such articles as are put into the mouth, such as eating-utensils, pipes, etc. The food may be contaminated by soiled hands. Invasion may also result from drinking stagnant water or water contaminated through the embryos being washed from the surface of the ground into the source of supply, or, according to Eichhorst, by passing through pipes whose joints have been plastered by clay that has become infected. The measures for prevention are such as are directed against any of these sources of infection, such as careful cleansing of the hands before eating, avoidance of the drinking of surface-water, etc.

Sonsino[1] found that sulphuric acid killed the parasites in one or two days and was a more powerful destructive agent than quicklime; the latter is, however, much more practicable. Saline water seems to be unfavorable to the vitality of the larvæ, and it is supposed that the presence of iron sulphate in the water of the Kremnitz mines explains the absence of the parasite there, whereas in neighboring and otherwise similar Schemnitz gold-mines it is abundant.[2]

But three anthelmintic remedies require notice: doliarin, male-fern, and thymol.

Doliarin is a crystalline principle extracted from the Ficus doliaria. It has been used empirically in Brazil with asserted excellent results.

The ethereal extract of male-fern has been much employed in Germany, the drug being given with the patient fasting and recumbent. It may be administered in doses of from 1 to 3 fluidrams (4.–12.) and repeated until the characteristic eggs can no longer be found in the feces.

Thymol is becoming recognized as the best anthelmintic agent in cases of

[1] *Trans. VII. Internat. Congress of Hygiene and Demography*, vol. i. sec. 1.

[2] Courtois-Suffit: *Traité de Méd.*

this form of parasitism. F. M. Sandwith[1] says that it is "a waste of time to administer any other anthelmintic than thymol." He has most carefully studied the use of the drug, and what follows is mainly abstracted from his paper. Upon the day before the administration of the drug the patient is placed upon a diet of milk and soups. The maximum dose is 4 grams (60 grains)—2 grams (30 grains) at 8 A. M. and 2 grams (30 grains) at 10 A. M. To enfeebled individuals 25 grams (f℥viss) of brandy are given with each portion. Two hours after the second dose magnesium sulphate or castor-oil is given. The first treatment brings away many parasites, but Sandwith thinks it unsafe to rest satisfied without a second trial. The average number of doses required in his cases was 2.6. Forty-two men were cured after one dose, 50 after two doses, 42 after three, 25 after four, 9 after five, 2 after seven, while 2 required eight doses to effect a cure. In some of his cases toxic symptoms—lowering of temperature, slowing of pulse and respiration, collapse, vertigo, and faintness—were produced. He considers that an age above sixty years, excessive debility, very low temperature, and advanced disease of the heart or other organ are contraindications. He advises that the doses mentioned be given not oftener than once a week.

For the profound anemia that results from the action of the ankylostomum the treatment differs in no wise from that employed against other forms of profound anemia. Rest, carefully regulated diet, iron, and arsenic should be employed as in pernicious anemia of idiopathic origin.

**Ascaris Lumbricoides.**—This parasite is probably identical with the similar parasite found in the hog. The eggs are voided with the feces in large numbers. The embryos undergo further development when the eggs are contained in damp earth or fecal matter, and are transported to the source of drinking-water or are transferred to the surface of food-stuffs, whence they are ingested by a second host and develop in his intestine into the mature form. Three or four months are required for the development of the parasite from the time of ingestion of the egg until arrival at maturity. Apparently the egg must pass some time without the body ere sufficient changes have occurred in the embryo to permit of development within the new host upon liberation from the egg by the action of the gastric juice. Were this not the case auto-infection would certainly be extremely common, as in the case of oxyuris vermicularis. The embryos within the egg have great power of resistance, and Davaine has found them alive in eggs kept for four years. That the intervention of an intermediate host, formerly thought to be a myriapod, is not requisite has been proved by feeding-experiments. This fact is also proved by the occurrence of the parasite in the intestines of breast-fed infants. Goats' milk was the only apparent medium of infection in the case of a three-weeks-old infant reported by N. Miller.[2]

*Prophylaxis* consists, therefore, in the boiling or careful filtering of the drinking-water and in the careful cleansing of all articles of food not sterilized

[1] "Observations on 400 Cases of Ankylostomiasis," *Lancet*, June 2, 1894, p. 1362.

[2] *Jahrbuch für Kinderheilkunde*, Bd. xxxvi. Hft. 3, p. 319.

by heat in the process of preparation for the table. It is necessary to note the liability to infection incurred by the habit of certain imbeciles and children of putting into the mouth articles taken from the floor or ground. Clay-eating is a prolific source of contamination.

*Medicinal treatment* is in most cases eminently satisfactory. When anthelmintics fail to produce an immediate and complete cure it is essential to so prepare the intestinal canal by dietary restriction and medicinal treatment that the specific anthelmintic may have the best opportunity for exerting its influence. The exact relation between chronic intestinal catarrh and intestinal parasitism has not been definitely determined, but the best results have been attained when the intestinal tract has been properly prepared prior to the administration of the anthelmintic. For this purpose a preliminary treatment of the intestinal catarrh by dietary and hygienic regulations, and the use of sodium phosphate followed by a course of alkaline and bitter tonics, will save much time and lead to much more certain results than will the immediate exhibition of the anthelmintic.

While many remedies have been employed against the ascaris, few are now of sufficient importance to deserve mention.

Santonica may with propriety be called a specific in this form of parasitism. The use of the powdered flowers was recommended by Guermonprez in doses of from 10 to 40 grains (0.65–2.59), given thrice daily in molasses, for the reason that they do not cause yellow vision, as does the active principle, santonin. Practically the only use now made of the drug is in the form of this active principle, the dose of which is to be regulated somewhat by the age of the patient, the average for a child being from $\frac{1}{4}$ to $\frac{1}{2}$ grain (0.016–0.032), that for an adult from 1 to 5 grains (0.065–0.32). Larger doses are frequently recommended, but not only will the doses named usually give ample satisfaction, but the use of larger doses is by no means without danger, as is shown by the numerous reports of poisoning therefrom. The yellow vision and discoloration of the urine that are early and characteristic manifestations may be followed by nervous or digestive symptoms that may be sufficient to cause death. Aside from these dangers from the larger doses there may be produced an urticarial rash.

Being almost insoluble in water, santonin is usually administered in powder. One of the most convenient methods of administration is to combine the drug with an equal or somewhat larger quantity of calomel. It may also be given rubbed up with sugar, a laxative being administered some hours later. It may be administered, with or without calomel, mixed with butter and spread upon a slice of bread, or it may be given dissolved in castor-oil. Another convenient method of administration is afforded by the official troches of santonin, each of which contains about $\frac{1}{2}$ grain (0.032) of santonin according to the U. S. Pharmacopeia, 1 grain (0.065) according to the British formula. The drug should be given at bed-time, for two reasons: at night there is least likelihood of interference from the presence of food, while by giving the drug at this time the annoyance caused by the yellow vision is avoided. It

should be given upon two successive nights, after which an examination of the stools for ova should be made before further drugging.

Sodium santoninate has been recommended for use, and has been admitted into the U. S. Pharmacopeia as an official drug. It is quite soluble in water, and on this account has been vaunted as a rival of santonin. It is, however, this very quality that prevents its equalling the latter drug in utility. Santonin being almost insoluble in ordinary menstrua is much less likely to induce toxic symptoms, while, at the same time, its insolubility ensures its retention within the intestine and consequent action upon the parasite. The dose of the sodium-salt recommended is from 2 to 5 grains (0.13–0.32) for a child, from 8 to 10 grains (0.52–0.65) for an adult, twice daily.

Santoninoxin has been recommended by Francesco Coppola[1] in place of santonin. According to this writer the toxic phenomena from santonin are due to the increased solubility of that substance brought about by the excessive formation of lactic acid that results from the accompanying catarrhal condition of the intestine. Santoninoxin is prepared by the action of hydroxylamin chlorhydrate upon santonin in alcoholic solution. It is a crystallizable, non-toxic body, and owing to its insolubility can be given in double or triple the dose of santonin. In view, however, of the great number of cases in which santonin is given without ill-effect it is hardly likely that this new substance will be much used. It might be of value when a second administration of an anthelmintic is needed in a case presenting toxic symptoms from the first administration.

Thymol has been used for the expulsion of lumbricoid worms with variable results. Sonsino[2] states that in giving this drug for ankylostomiasis the ascarides are sometimes voided, but that it usually fails to expel them. F. M. Sandwith,[3] on the contrary, in his experience with thymol has found that it acted quite as well as santonin. It may be given in doses from 5 to 60 grains (0.32–4.), according to the age and strength of the patient.

Chenopodium has been almost entirely superseded by santonin in the treatment of lumbricoid worms. The oleum chenopodii represents the activity of chenopodium, and is preferable to the crude drug. The powder may be given in sirup in doses of from 20 to 40 grains (1.3–2.59) before breakfast and at bed-time for three or four successive days, and should be followed by a cathartic. The volatile oil may be given in doses of from 4 to 10 minims (0.25–0.62) thrice daily, and be either followed by a laxative or combined therewith, as in the following formula:

℞ Olei chenopodii, ♏xij (0.74);
Olei ricini, ʒss (2.);
Olei cinnamomi, ♏j (0.062);
Syrupi acaciæ, q. s. ad ʒiij (12.).—M.

S. One teaspoonful on rising, after dinner, and at bed-time.

[1] *Lyon Médical*, Feb. 24, 1889, from *Lo Sperimentale*, July, 1887.

[2] *Lancet*, London, 1892, vol. ii. p. 1156.

[3] *Lancet*, London, June 2, 1894, p. 1363.

The oil may likewise be given in emulsion with extract of licorice to disguise the taste.

Spigelia, or pinkroot, has been much used as a narcotic vermifuge in the form of the fluid extract in doses of from 10 minims to 1 fluidram (0.62–4.) twice daily for three or four days; or it may be given with the fluid extract of senna, as in the extractum spigeliæ et sennæ fluidum of the U. S. Pharmacopeia of 1870, thereby avoiding the necessity for the subsequent administration of a purgative. The dose of this preparation is from ½ dram to 2 drams (2.–8.), depending upon the age of the patient.

The **Ascaris mystax** of the cat and dog has been found in man. As in the case of the lumbricoid worm, no intermediate host is necessary, the embryos developing when the eggs are kept in a moist medium. In spite of the fact that Grassi and Calandruccio have partaken of the eggs of this parasite with negative result, the possibility of direct infection renders the handling of dogs and cats a distinct source of danger. The same measures of medicinal treatment should be employed as are used for the expulsion of lumbricoids.

The **Ascaris maritima** has been observed but once in a human host, and we have no knowledge in regard to proper prophylactic or curative treatment.

**Oxyuris Vermicularis.**—The prevalence of this parasite renders the subject of its treatment one of great practical importance. One of the reasons for its obstinate resistance to treatment is to be found in the life-history of the animal. Having its habitat in the cecum, the eggs are discharged from the adult and are voided with the feces, the females usually wandering to the rectum or even upon the surface of the body to deposit the eggs. Leuckart has found the adult parasite even as far astray as the shoulders in a case of night-sweats. The embryo develops rapidly when surrounded by heat and moisture. No intermediate host is necessary. Owing to the intense irritation produced by the parasite in the rectum and upon the perineum an irresistible desire to obtain relief compels the sufferer to scratch the region about the anus. The eggs are thus readily transferred to the fingers, and on them are unconsciously conveyed to the mouth or deposited upon articles that are later taken into the mouth. For this reason reinfection of the original host can continuously occur, rendering all efforts at cure, particularly in the case of children, well-nigh hopeless. Infection of a bedfellow may readily take place from the migratory habits of the pregnant female and from contamination of the bedding by eggs.

*Prophylactic measures* are based chiefly upon the ordinary laws of personal cleanliness. The attendant upon an afflicted child should be especially warned as to the danger and means of infection. For the prevention of auto-infection several plans may be adopted. In the case of adults the danger of yielding to the desire to scratch the perineum should be insisted upon. Even in adults the itching is sometimes intolerable, and, aside from that circumstance, the scratching is frequently done during sleep. In children especially it is essential to provide against contamination of the hands. For this purpose various procedures may be adopted. The hands may be protected by gloves or may be confined by pinning or sewing the ends of the sleeves to the body of the night-

dress or to each other across the chest. Soothing applications may be made to the fundament, as mentioned later.

I have found it of decided advantage to delay the actual attack upon the parasite until the usual accompanying catarrhal condition of the gastro-intestinal tract has been removed. For this purpose careful regulation of the diet and the administration of slightly laxative doses of sodium phosphate may be instituted for a few days, whereby the quantity of mucus in the intestinal tract will be much diminished and the intestine so cleared that the anthelmintic remedies can act to the greatest advantage.

To be effective, treatment must be directed toward freeing the cecum as well as the rectum of the presence of the worm. It must consequently consist in the administration of remedies introduced through both mouth and anus. Of the numerous drugs recommended for use by both methods, but a few of the more reliable will be mentioned. By the mouth the most certain remedies are rhubarb, thymol, and santonin.

Rhubarb has been found very effective, and may be given in combination with an alkali in some such manner as indicated by the following formula:

| | | |
|---|---|---|
| ℞ | Pulveris rhei, | gr. xij (0.78); |
| | Magnesii carbonatis, | ʒj (4.); |
| | Pulveris zingiberis, | gr. ij (0.13).—M. |
| | In pulveres No. xij divide. | |
| S. | One twice daily for a young child. | |

As in many other forms of intestinal parasitism, thymol is of value. F. M. Sandwith[1] states that the oxyuris is usually completely expelled by the first dose of the drug given for the purpose of expelling the ankylostomum duodenale. The dose is from gr. ij to ʒss (0.13–2.), in accordance with the age and general condition of the patient.

Santonin has been highly recommended, used in the same way as when employed against the ascaris lumbricoides, but it is by no means so certain in effect in this form of parasitism.

Many drugs are recommended for the attack *per rectum*. The materials for enemata that have been recommended as specifics vary from simple salt-solution to quite complicated formulæ. Almost any substance injected into the rectum at bed-time will give a certain amount of relief, but I can agree with the majority in recommending the use of infusions of quassia (an ounce to the pint—32 : 500). Vinegar—in which, Vix states, the eggs quickly die—lime-water, combinations with oils and with ether or turpentine, are all doubtless capable of effecting relief. Thymol by enema has also been recommended, but there is danger of absorption and systemic poisoning if large quantities are thus given.

In giving the enema it is important to first thoroughly cleanse the bowel by a simple soap-and-water injection and then to introduce the tube of the syringe

[1] *Loc. cit.*

high up, permitting the medicated enema to enter slowly, and with the patient lying on the back, with the hips elevated and the body slightly facing toward the left.

Relief from the intolerable itching is best obtained by the use of a mild mercurial ointment applied to the perineum in the region of the anus, or, what acts still better, the insertion of an iodoform suppository into the rectum upon retiring.

**Trichocephalus Dispar.**—Like the oxyuris vermicularis this parasite lives in the cecum, is oviparous, and does not require the intervention of an intermediate host. It is found in monkeys, and is probably identical with the T. crenatus of the hog. The eggs require several months for development, and have great powers of resistance to desiccation and to the action of heat and cold. Heller, for example, found that after being frozen for several days the eggs had not lost their power of development. The eggs probably require the action of the gastric juice to permit of the escape of the embryo.

Infection occurs in the same manner as in the case of oxyuris vermicularis, viz., by auto-infection from soiling of the hands and subsequent transference of the eggs to the mouth, or of articles later placed in the mouth, or by the contamination of the drinking-water or of edibles that are not cooked in preparation for the table. The accidental contamination of lettuce and other vegetables, eaten uncooked, by the eggs of T. crenatus spread upon them in manure may be an added means of infection.

The best remedies for the condition are probably thymol and santonin. The latter drug, it is true, has been found by Heller to have no effect upon the parasite when brought in contact with it outside of the body; nevertheless, such negative experimental testimony should not prevent the use of the drug, inasmuch as there is considerable clinical evidence of its value.

Large enemata may be used to aid the anthelmintic, but it is important to remember the danger of absorption and toxic effects from such drugs as thymol when given in the large quantities required to flush out the whole colon. As the parasite is partially imbedded in the mucous membrane in a spiral manner, large enemata of plain water or saline solution may readily aid the anthelmintic in a mechanical manner.

**The Cestodes.**—In so far as medicinal treatment is concerned, this class of parasites may all be considered together. In regard to prevention, however, some division of the class is required in order to fully set forth the methods of prophylactic treatment. On this account the various forms of cestodes will be mentioned separately in so far as is necessary to a comprehension of their life-history and its bearings upon prevention. The treatment of the adult human parasite, being identical for all, will be described later.

*Tænia Saginata.*—The cysticercus, or larval form, is found in beef. Experimentally, this stage has been reached in the giraffe (Zenker) and in the goat and sheep (Heller) after these animals had been fed with eggs from the adult parasite.

Cattle become infected through the ingestion of eggs from the adult parasite,

either through taking them into the stomach with the drinking-water or through eating grass that has been contaminated by proglottides or eggs. The fact, theoretically plausible, that infected drinking-water is a possible cause of infection in cattle has been practically demonstrated by Joseph Fleming.[1] This author found that the cattle drinking from a certain large dirty tank became measled, and he discovered the ova of tænia saginata in the water. A few months after changing the source of supply of water the cattle ceased to show signs of infection. Promiscuous defecation by the bearers of adult teniæ may cause the disease, the proglottides adhering to the herbage of pasture-lands, or the eggs being carried by wind or water into the water intended for the use of cattle. When an animal or herd of cattle becomes "measled" it is only necessary for the animals to be removed from all source of infection for six or eight months in order to ensure a cure. At the end of that time the cysticerci will have been destroyed by Nature, and the flesh can with safety be used for food. In order to prevent the occurrence of the adult form in man it is requisite that official inspection of the living animal or of the flesh should be made, or that careful precautions be taken to thoroughly prepare the meat to be eaten, by means of heat or other agent destructive of the larval form. Inspection of cattle during life yields uncertain results. The most available point for inspection is the root of the tongue, but, aside from the practical difficulties in the way of such inspection, negative evidence is of no value in excluding the disease. Inspection of the flesh should include an examination of the masseter, pterygoid, gluteal, psoas, and lumbar muscles, while the liver should be also carefully examined. While the cysts are easily visible to the unaided eye it should be remembered that the dealer may entirely hide all superficial evidence of the disease by picking out the cysts apparent upon the surface. Accidental infection of other articles of food by mixture with scraps of measled beef left upon the butcher's block is a possible source of danger. Official inspection cannot take the place of care in thoroughly cooking all animal food. Perroncito has shown that the cysticerci are usually killed by a temperature of 44° C. (111.2° F.), and always so by one of from 47° to 48° C. (116.6°–118.4° F.). It is essential that the *whole* piece of meat should attain the temperature stated, as is further insisted upon in the article upon Trichina Spiralis (p. 513). Salting or smoking should be thoroughly effected, or else there is danger of the cysticerci remaining alive. As such meat is sometimes eaten without the application of any further treatment, thoroughness in carrying out these methods of preservation is important. Raw meat is not infrequently prescribed by physicians, and may become a source of infection unless the precaution be taken to thoroughly pound and press it through a sieve. According to Sonsino this treatment removes all danger of infection.

*Tænia Solium.*—Most of what has been said in regard to T. saginata will also apply to T. solium. Prevention of infection of the pig can best be accomplished by restraining this animal from access to human feces, a point by no means considered by the average farmer. As in the case of the cystic

[1] *Madras Monthly Journal of Medical Science*, February, 1873.

stage of T. saginata, the disease in swine is difficult of recognition. Inspection of the killed animal should include an examination of the liver, deep muscles of the face, tongue, shoulder, neck, and diaphragm.

*Tænia nana* has not been thoroughly investigated in regard to preventive treatment, the larval host being unknown.

*Tænia flavopunctata* passes its larval stage in certain insects—*Asopia formalis* in caterpillar and butterfly stages, *Anisolabis annulipes*, and in different coleoptera. The larva given to white rats produced tenia in the intestine, and in two men the same result followed (Railliet). Man probably becomes infected by the accidental ingestion, with the food, of insects containing the larval form.

*Tænia elliptica* and *T. cucumerina* are inhabitants of the intestinal canal of the cat and dog respectively. The larval stage is passed in the *Trichodectes subrostratus* of the former animal and in the *Trichodectes latus* of the dog. Lutz claims to have found the adult parasite in a dog free from external parasites, but the negative result does not exclude other modes of acquirement. To avoid unnecessary handling of dogs is a possible means of preventing infection.

*Tænia serrata* has for its larval host the hare and rabbit, from which it has doubtless been obtained by dogs, the habitual harborers of the adult form, and by the two men in whom it has been found.

*Tænia Madagascariensis* has been observed but twice in man, and methods for preventing its further occurrence are unknown.

*Tænia leptocephala* has been observed but once in the human being, and the source of contamination has not been traced.

*Bothriocephalus Latus.*—The larval stage of this cestode is passed in probably any of the following fish: the pike, lote, perch, salmon, turbot, tench, smelt, white-fish, grayling. Larvæ from the lote, salmon, and pike have been purposely administered to or taken by man, and have produced adult worms in the intestine. Proper care in the thorough cooking of fish is the only certain prophylactic measure, save such others as are directed against promiscuous defecation near bodies of water and consequent infection of fish by proglottides or eggs. It is stated that the cystic larva can remain alive after smoking, a point that needs further investigation.

*Bothriocephalus cordatus* probably passes its larval stage in some fish, as it is prevalent in fish-eating animals and among men has only been found in Esquimaux.

*Bothriocephalus cristatus* is of so rare occurrence that practically nothing is known as to its life-history, and therefore of possible preventive measures against its occurrence.

*Medicinal Treatment of Cestodes.*—As already stated, the medicinal treatment is similar for all of the cestodes. The number of remedies that have been used as teniafuges is astounding. Bérenger-Feraud[1] enumerates no fewer than sixty-one drugs that have been employed for the expulsion of these para-

[1] *Leçons cliniques sur les Tænias de l'Homme*, Paris, 1888.

sites. As in other cases, the large number of anthelmintics recommended is due to lack of certainty in the results obtained by drugs of this class, the failures in many cases being attributed to inefficiency on the part of the drug, whereas in reality the failure was due to the neglect of the user in respect of many of the details of administration. The removal of a cestode from the bowel should be regarded as an operation instead of being looked upon as a result to be obtained merely by the ingestion of a drug.

No matter what anthelmintic be selected there are certain rules that should be observed before, during, and after the administration of the remedy. As these are, with few exceptions, identical details of preparatory treatment, the general rules will be first given and the qualities and methods of using the various drugs will be considered separately.

Aside from the mere administration of the anthelmintic we must endeavor (1) to prepare the bowel for the operation; (2) to place the parasite in such a condition that the medicament can most powerfully effect its removal; (3) to avoid doing anything that might interfere with the removal of the worm entire; (4) to aid the anthelmintic by medicinal and other means to free the bowel of the parasite.

Prior to the actual attempt to remove the parasite the patient should be brought into the best possible physical condition, in order that the ordeal may be passed through to completion with as much celerity and vigor as may be necessary. For a day or two prior to the actual operation of removal the bowels should be gently cleared by sodium phosphate or other mild saline laxative, in order to remove excessive amounts of mucus and of scybalous masses. Free purgation is, however, to be carefully avoided. It was at one time thought (and the opinion is still held by some) that a preliminary purging was essential. Aside from the manifest uselessness of such treatment, there is danger of breaking the parasite and consequently interfering with its complete removal.

Upon the evening before the administration of the anthelmintic the patient's diet should be restricted to milk, bread or rice and milk, or dishes made solely of milk or cream and eggs. It is advised by Heller[1] that the patient be given upon the evening before operation a plateful of herring-salad, with onions and garlic, in order to sicken the worm. Upon the next morning the patient should remain in bed, in order to save his strength for the coming ordeal. No breakfast should be taken, as all of the teniafuges act better when taken on an empty stomach. While the patient is still recumbent, the teniafuge is administered either in one, two, or several doses according to circumstances and the drug employed. With most of the drugs this recumbency is essential in order to avoid failure through their rejection by the stomach; and with several it is an additional safeguard against the tendency to vomit, the nausea, and the vertigo that attend their use to have the patient keep his eyes closed.

Having administered the anthelmintic it is necessary to cause the expulsion of the worm. For this purpose senna, jalap, castor-oil, or calomel, or, in very

[1] *Ziemssen's Cyclopedia.*

robust individuals, repeated small doses of croton-oil or saturated solutions of the saline laxatives in small doses at intervals of ten minutes, may be used. Bérenger-Feraud advises the use of an infusion of from 10 to 12 grams (ʒiiss–ʒiij) of senna-leaves in 100 grams (fʒiij) of water sweetened with 30 grams (fʒj) of sirup of bitter orange-peel either a half-hour or an hour before the anthelmintic is given. This is particularly recommended when pelletierin is used, as it tends to overcome the paralyzing effect upon the intestinal wall produced by that drug. The patient should resist the desire to evacuate the bowels until the need is imperative, in order that the laxative action may be complete.

Should the laxative fail to act within an hour and a half, a purgative enema should be employed to aid it. For this purpose saline solutions with glycerin may be employed, or the formula of Bérenger-Feraud: Senna from 10 to 15 grams (ʒiiss–ʒiij), sodium sulphate 40 grams (ʒx), water 250 grams (fʒviij). The patient should evacuate the bowels into a large receptacle about two-thirds full of tepid water, in order that after expulsion search may be made for the head of the parasite.

In cases in which the worm is only partially extruded from the anus it is important that no efforts at traction be made, as not only is there great danger of thus breaking the parasite, but such traction cannot be effective. In such a contingency complete expulsion should be effected by the careful introduction of a syringe and the injection of cool water (100 parts) and ether (5 parts), whereby peristalsis is stimulated.

Bérenger-Feraud advises that the following armamentarium be prepared beforehand, in order to meet all contingencies that may arise: The teniafuge, purgatives, a purgative enema, some tepid water for making emollient enemata, a vessel three-quarters full of tepid water to receive the evacuation, and a decoction of 100 grams (ʒiij) of pomegranate in 250 grams (fʒviij) of water to serve as a teniafuge enema, if necessary.

After the parasite is evacuated, careful search should be made for the head, in order to determine the success of the operation. When the head is found, the disease is, of course, cured save when two or more parasites are present. If the head be not found it is best to await the renewed passage of proglottides before repeating the operation, and this for three reasons: the head may have escaped observation; the parasite may have been killed; the best time for attacking the worm is at the period of full maturation when links are shed.

In general terms it may be said that the contraindications against the attempt at removal are the extremes of age, great debility, and pregnancy.

When much weakness is displayed during the operation, such stimulants as aromatic spirit of ammonia, brandy, or strychnin may be administered, although it is best to avoid their use if possible, in order not to interfere with the contents of the digestive tract. It is best, therefore, to give the two last-named drugs beneath the skin when their use is called for.

The **anthelmintics** are so numerous that only those that have stood prolonged testing and are generally adopted will be mentioned. The best com-

parative estimate as to the value of each drug is given by Bérenger-Feraud,[1] and free use is made of his observations. It should be remembered that those cases only are by him called successes in which the head was obtained.

*Pomegranate* (Granatum), the bark of the stem and root of the Punica granatum, is a well-tried and satisfactory teniafuge. It contains four alkaloids, of which two alone possess teniafuge properties—pelletierin and isopelletierin. The bark of the root may itself be used in the form of a decoction, made by macerating 60 grams (℥ij) of the chopped dried root for twelve hours, then adding 750 grams (f℥xxiv) of cold water, boiling, allowing to macerate for twenty-four hours, and then evaporating to 500 grams (℥xvj). According to Bérenger-Feraud the greater the concentration the less the proportion of successes. The dose of the fresh root is 60 grams (f℥ij), that of the dried from 80 to 125 grams (℥iiss–℥iv). The British Pharmacopeia contains an official decoction made by adding two ounces (64.) of the sliced root to two pints (1 liter) of water, boiling down to a pint (500 cc.) and straining. The dose of this preparation is from f℥ij to f℥iv (60.–120.). According to Bérenger-Feraud this concentration is too great, and the prolonged boiling of itself, aside from the effects of concentration, may impair the efficiency of the volatile alkaloids.

The preparations made from the bark are so uncertain, owing to the difficulty of obtaining the fresh crude drug, and their taste is so disagreeable, that one of the alkaloids is usually preferred. The dose of pelletierin sulphate is 4½ grains (0.29). The addition of tannic acid to the sulphate prevents absorption of the drug and consequent toxic symptoms, without affecting its action upon the parasite. The form in which the alkaloids are usually administered is that of tannated pelletierin sulphate, sold under the name of Tanret's pelletierin, and manufactured in the laboratories of the discoverer of the alkaloids, M. Tanret. The cost of this preparation is great (three dollars for an average adult dose), but it will be often found to succeed when other remedies have failed. Bérenger-Feraud obtained success in 65 per cent. of 232 trials, but, as he says, owing to his extreme care in excluding all cases wherein the head was not found this proportion is too small, and probably 80 per cent. would be a fair estimate of the number of cures.

The directions given for taking this preparation are as follows: For delicate females and youths about fifteen years old, give two-thirds of the dose; for children of from ten to twelve years, one-half of the dose; for children of from four to eight years, one-third. On the evening before the administration a large injection should be given, and only a milk-diet taken. On the next morning the contents (or less, according to age and strength) of the bottle containing the dose should be mixed with a glass of sweetened water and given at one dose. Three-quarters of an hour later an ounce or less of compound tincture of jalap mixed with a glass of sweetened water should be given. If the bowels are not relieved in a few hours after the purgative has been taken, another purgative or an injection containing 30 grams (about an ounce) of

[1] *Loc. cit.*

sodium sulphate is given. In from two to four hours after taking the teniafuge the worm will be passed.

Bérenger-Feraud advises that in giving this preparation the contents of the vial (20 grams—f℥v) be poured into a glass, the empty vial filled with pure water and its contents again emptied into the glass, which will thus contain 40 grams (f℥x) of fluid. This proceeding is a safeguard against any of the dose being lost from adhesion to the sides of the vial. Half of the quantity in the glass is ingested by the patient at the start. If this be well retained the remainder is taken in ten minutes; or, if the drug be not well received by the stomach, the remaining half of the dose is given in divided portions of varying size at intervals regulated according to the amount of nausea induced. In this way all of the drug will be more certainly retained. A half-hour after the last of the pelletierin has been taken a dose of castor-oil in emulsion or in capsule is given. Jalap or the compound infusion of senna may be given instead of the castor-oil. Owing to the paralyzing effect of pelletierin upon the intestinal wall, the dose should not, in case of failure, be repeated until after the lapse of at least one week.

*Aspidium* is the rhizome of Aspidium filix mas. Its active principle is represented by the official oleoresin, which is extracted by means of ether and is a thick, oily liquid having a bitter, disagreeable, and nauseating taste. The crude drug is practically never used, as its administration in palatable form is impossible and its power depends upon the contained oleoresin. Upon standing, the oleoresin deposits at the bottom filicic acid. The teniafuge properties of the drug have been supposed to reside in this filicic acid, and it has been recommended to administer it in doses of 30 grains (2.). It is, however, much less firmly established as a teniafuge than is the oleoresin. The dose of the oleoresin is from f℥ss to f℥ij (2.–8.) or even more, according to some authors. An ethereal extract is also made by evaporating the oleoresin at very moderate heat in an oven, its dose being rather less than that of the oleoresin. It is not official in either the United States or Great Britain. The oleoresin is best given in capsules, either alone or in combination. Various combinations used are designed either to disguise the taste of the drug or to add some laxative medicament. Créquy's mixture is composed of male fern and calomel (1 : 10) in capsules, twenty of which are taken in the course of an hour, the twenty capsules containing 1 dram (4.) of the oleoresin and 7½ grains (0.5) of calomel. Some authors recommend the administration of two doses of from f℥ss to f℥j (2.–4.) of the drug at intervals of two hours on an empty stomach, followed in the evening by a purgative. Care must, however, be taken not to delay the purgative dose until too long after the administration of the anthelmintic. Bérenger-Feraud states that with male fern he obtained success—that is, certain expulsion of the head—in only 25 per cent. of his cases. Serious poisoning has resulted from overdoses of male fern, the symptoms of which will be found detailed in the standard works upon materia medica and therapeutics.

*Pepo*, or pumpkin-seed, is, according to the U. S. Pharmacopeia of 1890, the seed of the Cucurbita pepo. It is in great favor as a teniafuge, partly

from its small cost and partly because of the ease of its administration. The supposed active principle, peporesin, which resides in the perisperm, is not proved to be the teniafuge, nor has it been definitely proved in what part of the seed this property dwells.

The usual mode of administration is in the form of an electuary, 2 ounces (64.) of the seeds being crushed with sirup or honey after a restricted diet for twelve or twenty-four hours. The preparation is given in doses of from 6 drams to 2 ounces (24.–60.) early in the morning, on an empty stomach, at one dose, and a brisk cathartic such as the compound infusion of senna or castor-oil is given a few hours later.

Pumpkin-seed is a reliable anthelmintic, has no toxic properties, can be readily administered to children, and may be given repeatedly (in case of failure on the first attempt) without fear of injury. In 349 trials Bérenger-Feraud secured the head in 20 and obtained the expulsion of portions of the parasite in 329 cases. Pepo is thus not so effective as pelletierin, though cheaper, while its taste is less disagreeable than that of male fern.

*Brayera* or *Kousso* is the official name for the flowers and tops of the Hagenia Abyssinica. The female or red flowers are more active than the male or paler ones. The crude drug contains a yellowish-brown resin, koussin, which is soluble in alcohol, chloroform, and ether, and sparingly in water. The drug, having been macerated in cool or tepid water for some hours, is given in substance, on an empty stomach, in doses of from ʒij to ʒv (8.–20.), followed by castor-oil. The whole dose may be given at once or in fractional parts at intervals of ten minutes. For children the dose varies from 1 to 3 drams (4.–12.) according to age. It has been advised that the fluid expressed after maceration should be used, but as the resinous teniafuge principle is sparingly soluble in water, it would seem that the directions of Bérenger-Feraud to take the whole of the macerated mass are to be strictly followed. The taste of the drug thus prepared is nauseous and difficult to conceal. It may be more pleasantly administered by being made into an electuary with twice its quantity by weight of sugar. It may cause abortion when given to pregnant women. Koussin may be given in capsules, wafers, or pills—from three to five—the divided doses aggregating from 45 to 60 grains (3.–4.) for adults, from 20 to 30 grains (1.3–2.) for children. In 737 observations recorded by Bérenger-Feraud the head was obtained 67 times.

*Kamala* is composed of the glands and hairs from the capsules of the Rottlera tinctoria. It occurs in the form of a fine, granular powder of reddish color, is inodorous, and almost tasteless. It may be administered in powder in doses of from 1 to 2 drams (4.–8.), or, in the form of a saturated tincture in doses of from 1 to 3 drams (4.–12.), or it may be given with sirup of bitter orange-peel and aromatic water according to the method of Davaine. Excellent results have been obtained by some—48 out of 50 (Mackinson)—and the absolutely negative results in Bérenger-Feraud's nine cases must be ascribed to the poor quality of the drug used. The great disad-

vantage of kamala is the fact that age readily impairs its efficiency without inducing any manifest change in its physical characters.

*Turpentine* has had quite a reputation as a teniafuge, but is practically now abandoned for the more sure and less harmful drugs already enumerated. It is usually given in doses of from ½ ounce to 1 ounce (15.–30.) in capsules, or mixed with castor-oil or in emulsion with yolk of egg. Large doses are necessary to produce any result with tenia and there is grave danger of producing serious genito-urinary or nervous disturbance. In the only case in which I have used the drug obstinate strangury was absolutely the only effect produced, the tenia being later expelled by male fern.

*Thymol* has been used by some as a teniafuge, but its value is not as yet sufficiently tested. It may be given in capsules, twelve capsules each containing 10 grains (0.65) being given at intervals of fifteen minutes, the last dose being followed within a half-hour by a dose of castor-oil.

*Naphthalin* has been recommended, but has not as yet obtained rank among the teniafuges. It may be given in doses of from 2 to 20 grains (0.13–1.3) daily to children, in daily doses of from 20 grains to 1 dram (1.3–4.) to adults, but the best method for its administration has not as yet been settled.

Many other drugs might be enumerated as teniafuges. Quinin, nux vomica, and numerous other ordinary drugs have been given with subsequent expulsion of a larger or smaller number of proglottides. The various laxatives have, naturally enough, been followed by the expulsion of cestode links, yet such a result is not sufficient to warrant these drugs being classed as teniafuges. For instance, I at one time accidentally caused the expulsion of a great chain of proglottides of bothriocephalus latus by the administration of castor-oil; yet castor-oil should certainly not be classed among the remedies to be recommended for the treatment of this cestode, save as an adjuvant to the action of specific teniafuges.

In conclusion it may be again urged that the preparatory fasting for twelve hours and the details in conducting the *accouchement* should be most carefully effected, and that the removal of the cestodes should be looked upon rather as a medical operation than as the assured result of the administration of any drug.

**Anguillula Stercoralis.**—This parasite requires no intermediate host, is oviparous, and may grow in the bearer. The eggs are carried to the drinking-water and are so ingested. Prophylaxis consists, therefore, in boiling the water used for drinking and in the proper protection of the source of supply. Of drugs, thymol offers the best hope of cure and is recommended by Seifert in daily doses of 3 drams (12.). The oleoresin of male fern has also been used.

**Echinorrhynchus gigas,** to which variety the so-called *Echinorrhynchus hominis* probably belongs, infests both the wild and the domestic pig. The intermediate or larval host is the cockchafer or floral beetle. As in only one case (Lambl's) has this parasite been seen in man, and as there is small likelihood of infection from the cockchafer, but little need be said in regard to treatment.

**Echinorrhynchus moniliformis** occurs in rodents and has never been known to affect man, except in one instance in which the eggs were found in the feces of a Sicilian and in the case of purposeful infection of himself by Calandruccio. The larval host is the Blaps micronata, as has been proved by the feeding-investigations made by Calandruccio upon himself. This experimenter brought about expulsion of the parasite by the use of the ethereal extract of male fern.

### Non-intestinal Parasites.

**Trichina Spiralis.**—Owing to the importance of this parasite from both a scientific and a commercial point of view it will be necessary to enter into somewhat greater detail in regard to its life-history and the means of its exclusion than would at first sight seem proper in an article dealing only with the question of treatment. With the exception of some few minor points it may be said that the life-history of the trichina has now been fully ascertained.

The three important bearers of the trichina are the rat, the pig, and man. Briefly stated, the life-history is as follows: The encysted larval trichina dwells in the muscles. The flesh of the first larval host is eaten by another animal; the larvæ being liberated in the process of digestion, the parasite assumes the adult stage in the intestine of the second host; having arrived at maturity, the female brings forth swarms of living young, which gain access to the tissues and blood-stream of the bearer, migrate to the muscles, there become encysted, and are then capable of infecting a third host. Such, in brief, is the cycle of development.

Man is usually infected through the eating of pork containing living larvæ. The pig is infected by eating diseased rats, trichinosed pork, or possibly the excrement voided by a human bearer during the time of the intestinal or adult life of the parasite. The rat, likewise, is infected by the ingestion of its trichinous fellows or of trichinous pork, or possibly by the eating of human or porcine excrement voided during the stage of intestinal infection.

The two chief points in regard to prophylaxis are, therefore, the prevention of infection of the pig and the avoidance of the danger from consumption of pork so infected.

The pernicious practice of allowing pigs to have unlimited access to all forms of filth is largely responsible for the prevalence of trichinosis. The pig should be confined in an enclosure that will prevent its gaining access to excrement; rats should as far as is possible be eradicated from the neighborhood of the pen, and the offal from pork-butcheries should on no account be placed within their reach. The prevention of the disease in rats is far more difficult of accomplishment owing to their cannibalistic habits, but a part of the source of infection could readily be prevented by the destruction by fire of all refuse from slaughtered trichinous hogs. Such, then, are some of the measures that may prevent the infection of the pig.

In regard to human infection, much can be accomplished. Examination of

the geographic distribution of trichinosis will show that the disease is almost endemic in certain regions. It is less prevalent in America, where, according to Belfield and Atwood, 8 per cent. of slaughtered swine are trichinous, than in Germany, where rigid inspection of meat is enforced by law. The reason of this apparent paradox is not hard to find. The habit of eating raw or under-cooked meat is far less prevalent in America than in Germany, and, although inspection is not compulsory in the United States, save by the moral force of the inspector's stamp upon pork intended for interstate commerce and foreign export, it is found that trichinosis in America is so infrequent as to be looked upon as one of the curiosities of medicine.

Inspection of meat should not be disregarded as a prophylactic measure, chiefly from the fact that the greater the number of trichinæ present, the more danger is there from consumption of the flesh. Practically, however, we can only hope to limit somewhat the prevalence of the disease by this measure, for the reason that thorough inspection would require a minute examination that would be impracticable in the large slaughtering and packing houses that supply most of the pork to the civilized world. Imperfect inspection, by encouraging a false sense of security, would tend rather to aggravate than to diminish the prevalence of the disease.

Microscopic examination is essential for such an inspection. It is best performed by removing small bits from the pillars of the diaphragm in the direction of the muscular fiber, compressing these between glass slides, and examining under a power of from 80 to 100 diameters.

No better statement, as to the value of inspection, can be made than that by D. E. Salmon, chief of the Bureau of Animal Industry, Department of Agriculture of the United States.[1] It is as follows: "I contend that salting and cooking is a better protection than microscopic inspection, because we have no trichinosis in the United States from meat so treated, nor have any cases been caused in Europe by the millions and billions of salted pork that we have exported. On the other hand, there have been frequent and terrible epidemics of this disease in Germany, from the time microscopic inspection was instituted, about 1875 or 1876, until the present day, and many, if not all, of those epidemics resulted from inspected pork."

Protection from infection by trichina spiralis is, then, best afforded by proper preparation of hogs' meat. Heat, as employed in the processes of cooking, is undoubtedly the best agent of destruction for the larval form. According to the investigations of Perroncito a temperature of 120° F. (48.9° C.) is sufficient to kill the parasite. It must, however, be remembered that it is necessary for complete protection that all parts of the meat should be subjected to this temperature. Roast meats are more dangerous on this account, the central portions being more likely to fail in attaining this temperature, owing to the formation of a hard crust upon the surface that effectually shuts out a large amount of caloric. Boiling should be protracted for a time sufficient to allow of proper heating of the central portions—about fifteen

[1] *Trans. VII. International Congress of Hygiene and Demography.*

minutes for every pound of flesh. Freezing has no such definite unfavorable influence upon the life of the parasites, as Leuckart has found them living after an exposure for three days to a temperature of from — 22° to — 25° C. (— 7.6° to — 13.° F.), and Gibier found that they withstood a temperature of 25° F. (— 3.9° C.). Salting, if sufficiently prolonged, probably destroys the viability of the larval form, although Leuckart denies that the parasite is killed. According to Salmon, American pork exported to Germany does not cause trichinosis, as has been proved by experimental feedings at the hands of Brackbusch. Smoking has probably the same prophylactic influence, although careful feeding-experiments should be made to absolutely determine this point. Leuckart states that trichinæ sometimes live for months in flesh improperly smoked. Trichinæ resist putrefactive influence, and Cobbold found living trichinæ in a subject injected with zinc chlorid as a preservative.

The treatment of one who has partaken of trichinous meat must be instituted promptly, as hope of cure is to be entertained only during the intestinal life of the parasite. The expulsion of the viviparous and prolific adult from the intestine is essential for cure, as we have no means of successfully attacking the parasite after it has reached the muscles of the host and attained the encysted or larval form. This expulsive treatment should be instituted at once, as the female rapidly brings forth young that soon leave the intestinal canal, to be disseminated into regions inaccessible to treatment. Askanazy[1] found in rabbits that, upon opening the intestine after the lapse of from seven to ten days from the time of feeding with trichinæ, the females had penetrated the villi, and that free embryos were to be found in the chyle-vessels leading therefrom. Cobbold makes the statement that in from six to eight weeks the intestines are free from worms.

The treatment recommended for the expulsion of the adult from the intestine is both anthelmintic and purgative. Of anthelmintics male fern offers the best hope, and should be given in the same manner as when employed against the cestodes. Thymol has also been recommended in daily doses of 6 grams (ʒiss). Of purgatives calomel is probably the best, and is highly recommended by Davaine. It should be given in doses sufficiently large to produce active purgation, and should be followed, after the lapse of five or six hours, by a saline. Senna and aloes may also be used, but they are not so highly praised as is calomel. After the parasites have gained access to the tissues their destruction is impossible, and, as a rule, they produce no very harmful results after they have once become encysted in the muscles of the body. The remedies directed against them may actually produce more harm than the larvæ themselves. Among the drugs recommended for this stage of infection are the salts of picric acid and sulphur, but they cannot be relied upon to bring about any benefit.

For the rheumatoid pains produced by the migration of the young into the tissues, external heat and counter-irritant frictions may be employed.

**Filaria Sanguinis Hominis.**—In the case of this, as in that of many other

[1] *Centralblatt für Bakteriologie*, Bd. xv. No. 17.

of the human parasites, prevention far surpasses in practicability the curative methods of treatment. The means of prevention are readily appreciated when the life-history of the parasite, so far as it is known, is borne in mind.

For therapeutic purposes but little distinction need be made between the three varieties of this parasite that are now separated—diurna, nocturna, and perstans.

The life-cycle of the parasite may be summarized, for F. sanguinis hominis nocturna, in the following brief manner: The adult dwells within the lymphatic vessels of the human host. Its young, born living, are discharged into the lymph-stream and, in cases in which the lymph-channels are not blocked, reach the blood. The blood of the infested person is abstracted by the mosquito, and the parasite gains access to the stomach of the insect-host. The mosquito, gorged with blood, seeks marshy ground, where it dies, and the embryo filaria gains access to the water. Some further changes in development of the larva probably occur before it is swallowed with the drinking-water, through which it arrives in the human stomach. It then penetrates this organ and gains its permanent seat in the lymphatic vessels, to again infect the blood of a human bearer.

F. sanguinis hominis diurna has, in all probability, the same stages of development, except for the fact that, as Patrick Manson[1] suggests, the intermediary host is probably an insect that attacks man in the daytime—possibly the "mangrove fly." Manson states that both the geographic distribution and the habits of this insect go to bear out this theory.

The intermediary host of F. sanguinis hominis perstans is as yet unknown, but this will probably at some time be found to be an animal passing some phase of its existence in or near water. This is, however, simply theory as yet.

The point of attack in this life-cycle is evidently at the time when the animal might gain access to the human host. As this takes place through the ingestion of contaminated drinking-water, the prophylactic measures to be adopted are manifest: The drinking-water should be filtered, boiled, and kept in a covered vessel to which mosquitoes cannot gain access. Against the less well-known varieties—diurna and perstans—the same measures should be adopted, at least until further light is thrown upon their natural history.

For the eradication of the parasite several remedies have been advocated. Lawrie[2] and Walsh[3] have reported cases wherein the embryos disappeared from the blood or from the urine (in a case of chyluria) after the internal administration of thymol. Lawrie gave 1 grain (0.065) every four hours, increased after two weeks to 2 grains (0.13) every four hours, in one case; in another case he increased the dose to 5 grains (0.32) three times daily. In the first case the filariæ disappeared after two months of treatment; in the second, at the end of one month. On the other hand, Crombie[4] gave the drug in two

[1] *Trans. VII. International Congress of Hygiene and Demography.*

[2] *Lancet*, London, Aug. 13, 1892.

[3] *Indian Medical Gazette*, Dec., 1891.

[4] *Lancet*, London, Aug. 13, 1892.

cases. In one he rapidly increased from doses of 5 grains (0.32) three times daily until at the end of sixteen days he gave 200 grains (13.). In the second case he increased the dose from 5 grains (0.32) three times daily to 15 grains (1.) four times daily. In neither case did any benefit accrue. After the larger doses there was complaint of a burning sensation, but the patients readily stood doses of 15 grains (1.) three times daily—without, however, obtaining benefit.

Austin Flint[1] has reported a case of chyluria with the embryo filaria in the blood, wherein methylene-blue appears to have caused a cure. He gave 2 grains (0.13) of the drug every four hours for one day, with marked improvement in the state of the urine and lessening of the number of larvæ in the blood. Eight days later the urine became again chylous, and the blood-condition worse. On the tenth day the methylene-blue was again administered, and its use continued for five days. After the drug had been taken for three days, only a few motionless filariæ were to be found in the blood. After that time the urine continued normal and the general condition remained good.

Crombie tested the value of creosote in doses of 2 minims (0.12) three times a day; benzol, in the same dose gradually increased to 5 minims (0.31) three times daily; guaiacol, in the same doses; and gallic acid, in doses of 5 grains increased to 10 grains (0.32–0.65) three times daily, without any favorable results.

Sulphur, to saturation of the system, has also been recommended, but without certain proof of its beneficial action.

The advisability of employing any internal medication with a view of injuring or destroying the adult filaria is open to grave doubt. Manson,[2] in a strong paper on this subject, urges that we should rather make every effort to further the well-being of the adult female, in order that she may bring forth mature embryos instead of aborting. He shows quite conclusively that the lymph-paths are obstructed by the presence in the lymph of prematurely expelled and undeveloped embryos, and not by the embryos discharged naturally by the female. To quote from this paper: "There is a considerable body of evidence to show that under normal conditions the filaria is innocuous, and that it is only when abnormally located, or when it acts as an irritant, or when from some other cause the contents of its uterus are prematurely evacuated, or when it dies, that this parasite becomes a danger to its human host." Such being the case—and the proofs thereof seem extremely plausible—it can readily be seen that any antagonistic agents would be likely to produce exactly the ill-effects that we wish to avoid.

When lymphatic obstruction and consequent elephantiasis result from the presence of the parasite, surgical means are alone capable of doing good. When the obstructed lymphatic lies in such a position that operative procedures are permissible, the surgeon should excise the elephantoid portion of the body and endeavor to remove the adult parasite when it is in an accessible situation.

[1] *New York Medical Journal*, June 15, 1895.

[2] *Lancet*, London, Oct. 7, 1892.

If chyluria be present it is manifestly impossible to bring about a cure by surgical measures; and in such a case, when death from continuance of the trouble and exhaustion of the patient threatens, it would be justifiable to endeavor to destroy the parasite by the use of thymol or of methylene-blue; but little hope of obtaining a favorable result should be entertained, and the internal treatment should be regarded simply as a possible though doubtful means of relief. When the chyluria persists in spite of the absence of embryos in the blood or urine, stricture of the lymph-trunks is the cause of the symptom, and cure is beyond attainment.

**More Uncommon Forms of Filariæ.**—Among the class filaria are found seven other forms that have been seen in man. Filaria immitis, F. labialis, F. trachealis, F. hominis oris, and F. bronchialis have each been observed once in man. Their treatment would, so far as now known, consist in their mechanical removal when possible. Prophylactic measures may at some time be discovered, should further cases be observed. The same may be said of F. lentis, four cases of which have been observed in the human host. In regard to F. loa but little further can be said, save that Manson[1] thinks it possible that it is the parental form of F. sanguinis hominis diurna.

**Dracunculus Medinensis.**—Although it was formerly claimed that this parasite gained entrance to the subcutaneous tissues by direct perforation of the skin, it is now held that such is not the case, but that the larval form is taken into the body through the mouth with the drinking-water. The life-history is probably as follows: The adult being viviparous, the young dracunculus escapes from the human host (or from the ox, horse, dog, cheeta, or jackal, in which animals it is also found), gains access to stagnant water, and penetrates to the interior of a minute aquatic animal, now proved by Fedschenko to be a cyclops. Access to the human body is attained through the ingestion of the intermediary host either in the drinking-water or through accidental swallowing of contaminated water while bathing.

*Prophylaxis* consists in the use of pure spring or well water, in filtration or boiling of the drinking-water, and in avoidance of bathing in ponds wherein dwells the cyclops. C. Forbes[2] advises as an additional precaution the putting into the boiled and filtered water of a "thirst tabloid" of citric acid.

While the treatment of the acquired disease is properly purely surgical, it should be mentioned that two drugs have been advised for internal use. Horton claims that asafetida is a specific, and Forbes recommends the administration of one of Sir A. Garrod's compound sulphur-tabloids every four hours for ten days, then one twice daily for another period of ten days, so that the body may become thoroughly impregnated with sulphur. It is difficult to perceive how either of these drugs can aid in the elimination of the parasite.

Surgical treatment consists in cutting down upon the worm as it lies in its subcutaneous burrow, avoiding with care the division of large nerve-trunks, and then either carefully removing the parasite by coiling it by

[1] *Trans. VII. International Congress of Hygiene and Demography.*

[2] *Lancet*, London, February 24, 1894, p. 471.

degrees around a cylindrical quill attached to the skin by adhesive plaster, or by the constant application after incision of compresses of carbolic acid (1 : 15) over the wounds made. It is claimed by Roth [1] that by the latter means the whole worm will be removed and found upon the second or third daily dressing. Madhva Ras Vinzo claims that the leaves of the Indian plant "amarpattee," when bruised in a mortar, mixed with a little "chunan," and applied by means of a bandage, will bring about the exit of the worm.

### The Bladder-worms.

**Echinococcus Hominis.**—The larval stage of the *Tænia echinococcus* of the dog and wolf may at times be passed in a human host. The manner of its attainment is shown to be through the ingestion of the eggs or proglottides of the adult teniæ that have been voided by one of the adult bearers. It is a noteworthy fact that the disease is encountered far more frequently the more closely man and the dog are associated. The dog becomes infected by the ingestion of bladders from some animal that is the host of the larval form. In the intestinal canal of the dog the larval form attains maturity. The proglottides and eggs are voided with the feces. A six-hooked embryo develops, which, when favorably placed, bores its way from the intestine into the liver and other tissues of the second or larval host, to again develop into the larval or cystic form.

In order to prevent infection of the dog it is important, therefore, to prevent that animal from gaining access to the tissues of the larval host when the latter dies. For this reason dogs should, in regions where hydatid disease of man or animals prevails, not be allowed to prowl around slaughter-houses, nor should they be fed upon animal food that has not previously been subjected to heat.

In order to prevent infection of the human being by the larval form it is essential to guard against all possibility of the living eggs or embryos gaining entrance to the system. This entrance is always effected through the digestive tract. The segments, after being passed by the dog, disintegrate. The eggs are thus liberated and, being tough and resistant to external influences, are carried by wind and water in various directions. The proglottides when fresh are sticky and may readily adhere to and dry upon vegetable structures upon which they may have been voided, thus infecting the herbivora while grazing, or man when the infected plant is one that finds its way to the table. Careless or unnecessary manipulation of dogs, whereby the hands may be contaminated by the eggs, is probably a fruitful source in such countries as Iceland, where man and beast dwell together in intimate relation. The soiling of salads and other vegetables by the excrement of tenia-bearing dogs may readily be the means of infecting man unless proper care is exercised in the washing of such materials as are eaten in the uncooked state. The drinking-water, likewise, unless previously boiled or filtered, may be the medium whereby the species is continued in the human host. A practical point in prophylaxis is the frequent

[1] *Lancet*, London, March 31, 1894.

flushing with boiling water of the floors of kennels wherein dogs are confined.

Infection of the human bearer being only shown by the growth and resulting symptoms of the cystic parasite, no medicinal treatment can be of any avail. Kamala, turpentine, potassium iodid, and mercurial salts have all found advocates. The question of treatment thus resolves itself into two propositions: the parasite must be either killed *in situ* or removed from the body. Nature sometimes, and probably not infrequently, accomplishes a cure by the death of the parasite, with degeneration of the contents of the cyst. Attempts to aid Nature in bringing about this result have been made by various procedures.

The operative measures that have been used are: Simple tapping with trocar and cannula, tapping with aspiration of the contents, tapping or aspiration with subsequent injection of the cyst-cavity with various substances, electrolysis by means of puncture of the sac with needles subsequently made poles of a galvanic current, tapping with a large trocar and cannula with subsequent retention of the latter, free incision and drainage. It is unnecessary to say anything in regard to the technic of these various procedures, inasmuch as it in no wise differs from that employed in many other similar operations.

The operation of tapping, with or without aspiration, is the simplest of those named, yet it is by no means the surest or even safest, for various reasons —a single tapping rarely ensures cure, so that the operation has frequently to be repeated; when daughter-cysts are present it is an extremely unreliable method; and suppuration not infrequently supervenes and necessitates a further operation under unfavorable conditions. Davies Thomas[1] gives a table showing 45.91 per cent. of total failures, with 95 deaths, in 520 cases, while James Graham[2] found that of 75 cases of hydatids of the liver and lung, 6 died from the effects of the operation, 3 as a direct result of the tapping, and 3 from subsequent pleurisy. Very much the same might be said of tapping with subsequent injection of such substances as iodin and mercuric chlorid. It may be said, then, that tapping should only be performed for diagnostic purposes and with the intention of immediate operation by incision if found necessary.

Electrolysis may be efficient, but its use when the more thorough and rational operation by incision and drainage can be employed is hardly to be recommended. Owing to the rapid detachment of the true cyst-wall from the adventitious fibrous tissue, free hemorrhage may occur into the cavity emptied by tapping or aspiration, or the separated membrane may give rise to serious trouble by its death owing to loss of blood-supply.

Incision and drainage constitute the most rational operative procedure, with less risk of failure of radical cure and with no apparent disadvantages such as accrue to the apparently less severe measures. It has been recommended to perform the operation in two stages—primary incision down to the peritoneum and packing, or cauterization down to the cyst-wall—in order to cause adhe-

[1] *Trans. Intercolonial Medical Congress*, Australia, 1889.

[2] *Hydatid Disease in its Clinical Aspects.*

sion between the two layers of peritoneum and consequent exclusion of the peritoneal cavity from the seat of operation; and secondary evacuation of the cyst. With the great improvements lately adopted in the art of surgery it would seem best to perform the entire operation at one time, stitching the cyst-wall to the parietal wound.

The general principles of surgery must be applied to operations upon hydatids in regions other than the abdomen. In the case of pulmonary hydatids incision and removal certainly constitute the best method. John Davies Thomas[1] has collected thirty-eight cases of this operation, with recovery in thirty-two, while W. Gardner[2] records nine cases of thoracic section without a death.

For details of the various operations the reader may with advantage read Thomas' article already quoted.

The **Cysticercus cellulosæ** and the **Cysticercus tæniæ saginatæ** may be considered together, the two forms differing in regard to treatment only in the fact that one is the larval stage of the pork tape-worm, the other that of the *Tænia saginata*. As the means of infection are precisely similar, so will the same prophylactic measures be applicable to each form.

The human host in this form of parasitism is infected and affected in a manner practically similar to that of the more usual hosts of the teniæ—the pig and the ox—during the larval stage. Infection can only occur through the ingestion of proglottides or free ova of the adult teniæ. Such ingestion can occur from the contamination of drinking-water or of food by the excreta or ova voided by an individual harboring the mature form. Contamination of the drinking-water can readily occur from improperly placed privies or from the access of sewerage to the river, canal, or pond from which drinking-water is obtained. Infection may be conveyed by the food through the eating, without previous cooking, of salads or other garden-products accidentally contaminated by eggs or proglottides as a result of promiscuous defecation or of the use of human fecal matter as a fertilizing agent. So also fallen fruits may come in contact with and retain on the surface ova or fragments of proglottides deposited upon the ground with the evacuation of a human tenia-bearer.

Filtering or boiling, or, better still, a combination of these measures, will annul all danger of infection through the drinking-water; while careful cleansing of all foods intended for consumption in the uncooked state will prevent this as well as other forms of parasitism.

Probably the eggs undergo some developmental changes between the time of evacuation by the tenia-bearer and ingestion by the larval host; otherwise self-infection with the cysticercus would surely occur more commonly in the bearers of the adult form. Having gained access to the human stomach, the embryo is liberated and finds its way into the various organs and tissues of the body wherein the larval stage of development is destined to be passed. How long a time is required for this migration is not known, but it is stated that from three to four months are required for the development and protrusion of

[1] *Loc. cit.*

[2] *Trans. Intercolonial Medical Congress*, Australia, 1889.

the head after the ingestion of the ovum. It is, however, probable that but little of this time is spent within the digestive tract. Aside from this fact, we cannot hope to cut infection short during the stay of the embryo in the intestine, owing to the ingestion of the ova or proglottides being unsuspected and unmarked by any known characteristic immediate results.

Migration having occurred, nothing can be done in the way of cure except by surgical removal when practicable and desirable. Feletti reports a case of cure of superficial cysticerci after the administration of male fern, but it is extremely doubtful whether Nature did not do more than the medicine, as the larvæ may die from calcification in a few months, and it is difficult to conceive of any possible mode of action of the drug employed.

**Distoma Hepaticum.**—This parasite has been found in the liver of man and of the sheep, ox, goat, horse, ass, pig, rabbit, guinea-pig, and in some wild animals. From its seat in the hepatic channels it discharges its eggs into the biliary ducts, from which point they reach the intestine and are voided with the feces. The ovum, having been maintained for a time in a moist medium at a moderate temperature, undergoes further development. Having been carried into some body of water, a ciliated embryo escapes from the egg, and finally enters the respiratory apparatus of a gasteropod (Limnæa truncatula), where it becomes developed into a sporocyst. This sporocyst by scission gives origin to redia or parent-nurses. These redia escape into various parts of the snail-host and give birth to daughter-redia or cercariæ (resembling the adult distomes save for the absence of genital organs). The cercariæ leave the body of the snail and attach themselves to various aquatic plants, upon which they become encysted. The plant so attacked is eaten by an animal, the living contents are liberated in the stomach and find their way into the biliary channels of the new host.

Such being the life-history of the parasite, the prophylactic measure to be adopted is the thorough cleansing of all aquatic plants used as food. Such parts of these plants as grow below the surface of the water should be rejected and the remainder carefully cleansed.

After having gained access to the liver, treatment is absolutely ineffectual.

**Other Distomes.**—Of other distomes that have occasionally been found in man but little can be said in regard to treatment, owing to our ignorance as to their evolution and to our inability to influence them by treatment after they have gained entrance into the liver of the human host. In regard to *Distoma crassum* it should be said, however, that Walker and Giles[1] have caused its expulsion from the duodenum by thymol given for ankylostomiasis. It is supposed that the cercarial host of *D. lanceolatum* is a snail, but beyond that point nothing is even surmised.

In view of the absence of definite knowledge to the contrary it is wise to view the life-history of all of the distomata as closely resembling that known of *D. hepaticum*, and to adopt, in countries in which these parasites are known to have occurred, the same prophylactic precautions as were mentioned in the discussion of the latter parasite.

[1] *British Medical Journal*, December 5, 1891.

**Bilharzia Hæmatobia.**—This parasite is undoubtedly derived from the drinking-water, wherein its ciliated embryo may be contained. While the whole life-cycle has not as yet been completely ascertained, and although feeding-experiments upon various animals have so far yielded negative results, with our present knowledge, and reasoning from analogy, it would seem that care in the selection of and filtering or boiling the drinking-water, and avoidance of accidental ingestion of contaminated water by bathing, are the best means of prevention at our disposal. The eggs are voided in the urine, and reaching water develop further, but the exact host has not been definitely ascertained; the haddock and molluscs have been accused upon uncertain grounds as being guilty of so harboring the parasite during its larval state.

The fact has been proved that the eggs and embryos perish in decomposing urine, so that there is some ground for believing that care in the location of latrines and privies, with protection of the water-supply from direct contamination, might be a sufficient safeguard against infection. It is important to bear in mind the fact that sheep also act as hosts of the adult worm. The parasite being situated in the portal vessels and veins of the mesentery and bladder, it is manifestly impossible to effect its discharge from the body. The urinary symptoms produced being those caused by the exit of the immature animal through the bladder-wall and by venous stasis, it is evidently highly improper, as Cobbold strongly urges, to endeavor to secure benefit by topical applications to the mucous membrane of the bladder, as such interference cannot fail to remove clots and prevent closure of ruptured vessels, while no good results can be expected to accrue. Cobbold recommends the internal administration of buchu and bearberry. F. M. Sandwith has experimentally investigated the value of thymol in the treatment of this affection, but has so far met with no success.

From what has been said it is evident that prophylactic measures are of far greater value than are medicinal remedies.

**Distoma Ringeri.**—The ova of this parasite escape from the lungs in the sputum. According to Manson,[1] the ova must soon gain access to water, as his experiments showed that in a watch-glass the ciliated embryos developed from the eggs only in water that was renewed at frequent intervals. The parasite is undoubtedly ingested with the drinking-water, but whether further stages of development are required or another host is necessary is not known. Boiling the water intended for drink would prevent infection.

Cure resulted in one of Manson's cases after the use of a steam-spray of tincture and infusion of quassia, infusion of kousso, solutions of turpentine and santonin in spirit of wine, and inhalations of burning sulphur. To which of these remedies the cure was to be attributed is not clear from the report.

**Pentastoma Tænioides.**—Man can act as host for either the larval or the adult stage of this parasite. Ordinarily the adult is an inhabitant of the nasal fossæ of the dog and some other animals. The ova are ejected from the nose during the act of sneezing, and are ingested by herbivora (including man).

[1] *Filaria sanguinis hominis*, etc.

Having reached the stomach of the latter the shell of the ovum is destroyed by the gastric juice, the embryo is liberated and penetrates into the liver or lung, where it becomes encapsulated. The viscera so infected are eaten by the dog, and the larva gains access from the mouth or gullet to the nasal fossa, there to develop into the adult form.

Care in the cooking of food and in the protection thereof from contamination by dogs will prevent all danger of human infection. Close contact with dogs may readily be the cause of infection by accidental contamination of the hands by the ova.

**Eustrongylus Gigas.**—While not uncommon in the lower animals, this parasite is but rarely found in man. It is a mediate parasite, requiring the intervention of a larval host, generally supposed to be a fish. Aside from the careful cooking of fish there are no preventive measures, while of curative measures we have no knowledge.

**Strongylus Paradoxus.**—Occurring in the respiratory organs of the pig there is but little opportunity for the acquisition of this parasite by man. The solitary case in which it was discovered in the dejecta of a dealer in fresh pork must be looked upon as an accident that can rarely occur.

The solitary specimen of *Strongylus longevaginatus* found in the lung of a child in Transylvania furnished no hint as to prophylactic measures required to prevent a repetition of its occurrence.

# RHEUMATISM.

By JAMES STEWART.

## Acute and Subacute Articular Rheumatism.

Acute articular rheumatism is a general febrile disease with local manifestations. Numerous hypotheses have been advanced from time to time to explain the true cause or nature of the disease. The theory that it is due to the accumulation of lactic acid in the blood finds but little favor at the present time. Its origin in a like accumulation of uric acid has been also advanced, but on very flimsy ground.

Dr. Wilde, in a recent paper, attributes the disease to a change in metabolism brought about by the depressing influence of cold, or of excessive muscular or nervous fatigue. This change, he contends, leads to that acid state of the tissues and secretions characteristic of the disease. Owing to the imperfect metabolism, he says, the acids are manufactured in the tissues themselves, instead of being conveyed to them by the blood. On this theory he bases a form of treatment that will be referred to later. The theory that acute rheumatism is of nervous origin has never received any general support.

There are many reasons why the disease should be considered among the acute infections. Still, we have not as yet fully determined the presence of an undoubted micro-organism. Sahli has described bacilli which he found in the fluid of an inflamed joint, but further investigations are necessary before the alleged causal connection can be established.

In the **treatment** of acute rheumatism we endeavor to employ—(1) Such measures as an accumulated experience has shown to be of value in relieving local inflammation. (2) General measures to counteract the essential cause of the disease.

There is no measure to be compared with rest in the treatment of a local inflammation. In acute rheumatism by enforcing rest we lessen the inflammatory action in the joints involved, and we also lessen and to some extent undoubtedly prevent endocardial and pericardial inflammation. In acute cases the severity of the pain compels rest. In the subacute cases, however, the same necessity is not forced on the patient. It therefore is the duty of the physician to see that such rest is secured. Endocarditis and pericarditis occur frequently from so-called mild attacks, and cases of acute rheumatism with almost no articular affection are not uncommon. It is all-important, therefore, to insist on the patient's keeping his bed, not only in cases of pronounced

arthritis, but also in those cases in which the other manifestations of the disease form the chief clinical features. It is a difficult matter to say when it is safe for the patient to leave his bed. During the stage of pyrexia and for several days afterward nothing but good can result from lying in bed. The danger of a relapse is certainly lessened, and if there is any cardiac complication present its extent and after-effects are minimized. The practice of keeping a patient lying between blankets is seldom called for. If sweating is profuse, lying on a blanket is all that is necessary.

**Local Treatment.**—The various local measures usually employed include cold, splints, blisters, anodynes, etc. The application of cold, although extensively employed on the Continent of Europe, has never found favor with the physicians of either America or England. It is a measure of doubtful utility. In severe cases great relief is obtained by placing the inflamed joints in light splints. In the majority of cases all that it is necessary to do is to wrap the joints with cotton-wool, after having applied a simple anodyne lotion. A useful and favorite lotion is Dr. Fuller's, which is composed of—

| | | |
|---|---|---|
| ℞ | Tincturæ opii, | f℥j (30.); |
| | Potasii carbonatis, | ℥ss (16.); |
| | Glycerini, | f℥ij (60.); |
| | Aquæ, | f℥ix (270.).—M. |

S. To be applied to the inflamed joints on warm lint.

The dressing should not be covered by any impermeable material.

An ointment of ichthyol is often effective in allaying pain.

The application of blisters above and below the affected joints is often followed by marked relief, but is not to be recommended owing to the disagreeable local and possibly remote effects. Cases of acute nephritis have been reported as the result of the irritating effects of the cantharides on the kidneys.

Osler speaks highly of the light application of the Paquelin thermocautery.

**Internal Treatment.**—The internal treatment of acute rheumatism has during the past twenty-five years undergone many changes. Previous to 1870 the profession closely followed the lines laid down by Fuller. This consisted in giving large quantities of alkaline agents. The prevailing theory of the nature of the disease at the time was that it was due to the presence in the blood of lactic acid, and it was plausibly argued that the alkalies constituted a natural antidote. "The sooner the urine is rendered alkaline the better," was the teaching of those days. Soon, however, the results obtained by Gull and Sutton from treatment with simple rest so disturbed the average medical mind that we had the other extreme—leaving the patient to lie in bed for a period of six weeks without any special treatment. It was while the profession was hovering between these two extremes that the results of the use of salicylic acid were published by Buss, of Basle, in 1875, and by Stricker, of Berlin, in the following year. Since that time, although

many different agents have been recommended, the salicyl-compounds still remain our chief means of combating the disease.

The salicyl-treatment of acute rheumatism will be considered under the following heads:

(1) Its influence upon the symptoms of the disease, and especially its effects on the joint-pain and the pyrexia.

(2) Its influence in preventing and ameliorating the cardiac and central manifestations of the disease.

(3) Its influence on the total duration of the disease.

(4) Is it true, as is commonly alleged, that relapses are more frequent than with other methods of dealing with the disease?

(5) Mode of action of the salicyl-compounds in acute rheumatism.

(6) The various untoward effects met with from the use of these compounds.

(7) Preparations usually employed; their doses and mode of administration.

1. *The Influence of the Salicyl-compounds on the Pain and Other Symptoms of the Joint-inflammation.*—The first distinctly noticeable effect of salicylic acid in severe cases of acute rheumatism is the relief of pain. Usually by the time a patient has taken 60 grains (4.) in divided doses he feels some relief and in the great majority of cases the relief is very pronounced by the time 120 grains (8.) have been taken. If half an ounce (16.) of the sodium salt is taken in twenty-four hours, the pain is reduced to a minimum in fully 75 per cent. of all the severe cases. It is very exceptional to meet with cases of true acute rheumatism in which the pain is not thus quickly and distinctly relieved. In subacute cases the relief is, however, not very marked, often even when the drug has been given for many days.

*The Influence of the Salicyl-compounds on the Pyrexia.*—Coincident with the relief of the pain in the joints there is almost invariably a marked decline in the pyrexia of the disease. Frequently the temperature falls before there is distinct relief from the pain. This would seem to show that the pyrexia of acute rheumatism is independent of the inflammatory changes in the joints.

It appears to be a well-recognized clinical fact that the cases of acute rheumatism attended with considerable fever (103°F. —39.4° C.) are more quickly and more profoundly relieved than those in which there is slight fever. The rapidity with which pyrexia is relieved by the salicyl-compounds depends on the dose and frequency of administration—half an ounce (16.) in twenty-four hours having more effect than the same quantity spread over thirty-six hours.

2. *The Influence of Salicyl-drugs in Preventing the Cardiac Manifestations of Acute Rheumatism.*—There are various opinions expressed as to the power of the salicyl-preparations in preventing cardiac complications. Many hold the view that these preparations have no influence whatever in this respect—that they simply relieve the pain and reduce the pyrexia, but that there is no direct action on the cause of the disease. It is claimed by those who hold these opinions that cardiac complications are more frequent under salicylates than under alkalies, or even under an indifferent treatment. The statistics collected by

Dr. Hood[1] were based on the treatment of 2220 cases of acute sthenic rheumatism in both sexes under thirty-six years of age. Of these cases, 850 were treated in Guy's Hospital before the introduction into practice of the salicylates; the remaining cases were treated with the salicylates in Guy's and St. Bartholomew's hospitals. Out of the 850 cases treated in various ways, but without the salicylates, it was found that 500 had cardiac complications. "Examining the salicylate cases in series as they were collected, of 328 cases from Guy's, 190 were affected. In a second series, from Guy's, of 360 cases, 241 had cardiac complications; and again in 515, from St. Bartholomew's, 316 were affected." In the cases treated with the salicylates it was found that in the aggregate slightly over 60 per cent. were affected, while in those cases treated by various other methods slightly under 60 per cent. were affected. As Dr. Hood points out, these percentages practically agree, and show that the salicylates are no more effective in preventing cardiac mischief than is any indifferent treatment. The percentage of cardiac disease in the cases treated with salicylates does not differ from the usual proportion of cases of cardiac disease, it being generally admitted that from 50 to 60 per cent. of all cases are attended with this complication.

If the direct influence of the salicylates appears to be but slight, it must be admitted, I think, that they have a very considerable indirect action, through diminishing the total number of days that the heart is exposed to the risk of infection. The salicylates have no doubt an influence in lessening the extent and severity of an endocarditis, through their power of lowering the force of the heart and the blood-pressure. It is therefore good practice to continue their use during the acute stage of the cardiac complication, even if pain and fever have been absent for some time.

*The Influence of the Salicylates in the Prevention of Hyperpyrexia.*—If statistics on the point are reliable, hyperpyrexia is a much less common complication of acute rheumatism in cases treated with salicylates than in those treated with other drugs. Whether this change is due directly to the salicylates or not we have no facts to prove. Cases of hyperpyrexia have been reported as setting in during profound salicylism, showing that they are at least not effective in all cases.

After hyperpyrexia has once set in, the salicylates are useless.

3. *The Influence of Salicylates on the Total Duration of the Disease.*—There can be no doubt that in the salicylates we have a very powerful means of greatly lessening the duration of the acute symptoms. If no cardiac manifestations are present, the disease will in the great majority of cases terminate within two weeks. If, however, the latter are present, the patient will be compelled to remain in bed as long as he would under an alkaline treatment.

4. *Is it true, as is commonly taught, that relapses are more frequent than from other methods of dealing with the disease?* There can be no doubt that it is a frequent occurrence to meet with relapses, no matter what treatment is employed. I do not, however, believe that there is satisfactory proof to show that such

[1] *Lancet*, London, April 14, 1888.

relapses are more frequent after the use of the salicylates than after other methods of treatment. It is in my opinion probable that the great relief obtained by patients from the action of the salicylates renders them impatient of further treatment in bed, and that the change to the horizontal position is in a great measure accountable for the relapses. I believe there is good ground for the remarks of Dr. Burney Yeo on this point in his work on *Clinical Therapeutics*. He says, "We have not found that relapses are more frequent, as has been stated, after the salicylates than after other methods of treatment, especially if the treatment is maintained, as it should be, in a modified form for a fortnight after the cessation of the primary acute attack."

I believe that recent evidence (and my own experience coincides with this) tends strongly to support this view of Yeo's.

5. *Mode of Action of the Salicyl-compounds in Acute Rheumatism.*—In the present state of knowledge it is impossible to explain satisfactorily the mode of action of salicylic acid in acute rheumatism. Many different views are expressed—all mainly based on the conception of the nature of the disease held by those who have advanced these different theories. Those who, for instance, consider acute rheumatism as an infectious disease explain the action of salicylic acid by a direct influence on the causative micro-organism or its products; those who adhere to the lactic-acid theory refer the action of the salicylates to an influence in counteracting the formation of lactic acid. Dr. Haig's hypothesis, recently advanced, is to the effect that the salicylates promote the elimination of uric acid. Another explanation is that the action results from some influence on metabolism; still another, that it is from an influence on the nervous system. All of these views as to the action of the salicylates are based on purely theoretic grounds, and until we know something definite about the nature of the disease we are likely to remain ignorant as to the mode of action of the agents that are most efficacious in its treatment.

6. *The Untoward Effects of the Administration of the Salicylates.*—Unfortunately it is not uncommon for salicylic acid and its salts to cause disagreeable effects. The minor effects known as salicylism, such as ringing in the ears, deafness, and dimness of vision, are seldom troublesome enough to necessitate the withdrawal of the drug.

Salicyl-delirium is a much more important effect and is not an infrequent manifestation. It occurred 32 times in 174 cases treated in Guy's Hospital between the years 1881 and 1886.[1] It is especially common in inebriates and those of a neurotic temperament. It occurs in all degrees, from talking during sleep up to furious mania. In its severer types it is usually attended by auditory and visual hallucinations. It may be mistaken for the delirium attending the hyperpyrexial state.

Symptoms of cardiac depression have been reported in the course of treatment with the salicylates, but are seldom met with except when very large doses have been taken or when an acute or chronic nephritis so interferes with elimination by the kidneys that the drug accumulates in the system.

[1] Quoted by A. E. Garrod: *Treatise on Rheumatism.*

Symptoms of renal irritation are sometimes noticed. Albuminuria and hematuria were met with eight times in the 174 cases already referred to. Nausea and vomiting are also occasionally observed.

Among other symptoms encountered may be mentioned epistaxis, retinal hemorrhages, erythema, urticaria, petechial spots, and intense itching of the skin, sometimes in association with the skin-eruptions named and sometimes without any visible change in the skin.

7. *Preparations Usually Employed; their Doses and Mode of Administration.*—Sodium salicylate is on the whole the most convenient and probably the least objectionable of all the salicyl-compounds. Salicin has also much to recommend it, but when it is important to quickly affect the disease we believe that the sodium salt acts more quickly and more powerfully. The following method I have found of value: First, to give sodium salicylate for a period of three or four days or until such time as a decided impression is made on the pyrexia and pain, and then to replace it by salicin, which is to be continued for several days after the disappearance of all symptoms. By adopting this method we obtain, in the first place, the prompt and decided action of the sodium salt. Secondly, we are less likely to meet with untoward effects from salicin. We, therefore, in a measure, obtain by this method the most desirable action and minimize the untoward effects of the salicyl-compounds.

Natural sodium salicylate should always be used in preference to the artificial product. It is claimed, and I believe with justice, that the impurities present in the artificial acid are mainly responsible for the disagreeable symptoms that sometimes follow its ingestion.

I have had some experience with sodium dithiosalicylate (a salt having the composition of two molecules of salicylic acid linked with two atoms of sulphur). It is rapid in action, but in dose of 5 grains (0.32) and upward it very commonly induces diarrhea.

The oil of gaultheria (wintergreen), which contains impure methyl salicylate, is highly recommended by Osler, Wood, Kinnicutt, Hare, and others. It is said to be as effective as sodium salicylate and to be much less likely to bring about the usual disagreeable effects of the latter drug. Reports are, however, contradictory on this point. It, like the other salicyl-compounds, induces the ordinary symptoms of salicylism—and if these, then in all probability the delirium and other graver symptoms as well. The dose of the oil of wintergreen is from 10 to 20 minims (0.62–1.23). It is best administered in capsules.

Salol, another salicyl-compound, is less used now than formerly as a substitute for salicylic acid or its sodium salt. In the intestines it is split up into its phenyl and salicyl elements. Its value in acute rheumatism clearly depends on the salicyl-element, and experience has shown that it is no more efficient than a corresponding dose of salicylic acid. It is open to the great objection that it may readily cause renal irritation (carboluria). The dose varies from 4 to 20 grains (0.26–1.3). It can be administered in cachets or pills.

Salophen, a preparation containing about 50 per cent. of salicylic acid, is

said to be as effective as an equal amount of the acid itself, and to be free from any specially irritating effects on the kidneys. The dose is from 10 to 20 grains (0.65–1.3) in cachets.

Paracreosotic acid and sodium paracreosote both have an action similar to that of ordinary salicylic acid, and it is claimed by some that they are not so likely to cause disagreeable effects.

Paracresol salicylate, in doses of from 2 to 10 grains (0.13–0.65) in cachets, is also recommended as an effective agent in the treatment of acute rheumatism.

In my opinion, all of the foregoing substitutes for salicylic acid are decidedly inferior to the sodium salt. I invariably begin the treatment of the disease with this salt, usually commencing with 15 grains (1.) every two hours until symptoms of salicylism are developed. The salt is continued for twenty-four hours longer in a quantity sufficient to keep up the ringing in the ears, etc. The subsequent administration depends mainly on the pyrexia and the pain. When these symptoms have entirely disappeared, it has been my custom to continue the salt in divided doses of from 60 (4.) to 90 (6.) grains in the twenty-four hours, this being kept up for a week or ten days. If, after a trial of full doses, no relief is obtained (a very unusual event), it is, I believe, unwise to continue the administration of the remedy.

Although it is not necessary to induce the symptoms of salicylism, as a rule it will be found that in severe cases marked relief is not obtained before these symptoms appear. The practice of discontinuing the sodium salt when cardiac complications set in is not, in my opinion, a judicious procedure. My practice in such cases is to combine the drug with an alkali, such as potassium bicarbonate. I see no objection to the administration of both from the very beginning.

Sodium salicylate may be prescribed as follows:

℞ Sodii salicylatis, ʒiij (12.);
Syrupi zingiberis, fʒj (30.);
Aquæ, q. s. ad fʒvj (180.)—M.
S. A tablespoonful every two or three hours.

The fluid extract of licorice may also be used as a corrective.

Bourget[1] reports considerable success from the application of an ointment of salicylic acid in the treatment of acute rheumatism. He has used hog's fat, lanolin, and turpentine as excipients. He has proved that in this way the salicylic acid is quickly absorbed. He reports nineteen cases treated according to this method, with success, the pain and pyrexia disappearing as quickly as if the acid had been administered internally.

Ruel[2] reports similar favorable results from the application of ointments of salicylic acid to the skin in acute rheumatism. Erlanger[3] of Munich has treated acute rheumatism with injections of salicylic acid into the rectum.

[1] *Rev. méd. de la Suisse romande*, August, 1893. [2] *Ibid.*
[3] *Deutsches Archiv für klinische Medicin*, Bd. li.

No doubt the usual physiologic effects of all salicylates can be obtained by absorption through the skin and from the rectal mucous membrane, but the cases must be few indeed in which it will be necessary to resort to such a slow way of introducing the medicament into the circulation.

*Antipyrin, Acetanilid, Phenacetin, and Allied Agents in the Treatment of Acute Rheumatism.*—All members of the coal-tar group of antipyretics are used with more or less success in the treatment of acute rheumatism. By some it is asserted that they have a direct or specific action—an action independent of their antipyretic and analgesic effects. There is no doubt that all have direct antipyretic and analgesic actions in acute febrile diseases, but any further action, I believe, remains to be proved. H. A. Hare,[1] while believing that antipyrin quickly relieves the pain, finds it not so efficacious as acetanilid in diminishing the duration of the disease. In an extended experience with the latter he has seen it relieve the pain when the salicylates and iodids have failed to do so. He says: "I have found that acetanilid . . . . will often relieve the pain, and so permit a refreshing sleep, in doses of from 4 to 8 grains (0.26–0.52) three times a day, and that these amounts do not cause the excessive sweating which necessarily large doses of salicylate are sure to produce—sweats which leave the patient oftentimes almost dyspneic from very weakness. Whether this temporary relief produces such changes in the system as to permit of a better battle against the disease, or whether it actually counteracts the rheumatic poison, I do not know; but I do know that following its employment, the relief is not only temporary, but often permanent, and that a very distinct step in advance is made toward the close of the attack if any influence at all is felt."

The dose of acetanilid varies from 4 to 8 grains (0.26–0.52). It can be prescribed in the form of powder and taken in cachets. Antipyrin can be prescribed in the same way or in solution, and in doses of from 10 to 20 grains (0.65–1.3). The dose of phenacetin is from 5 to 15 grains (0.32–1.), in powder.

There is little to choose between this group of agents and the salicylates in the matter of disagreeable effects. The members of the coal-tar group require to be watched closely as to their effect on the heart and on the blood. In large doses they all more or less depress the action of the heart, and they at times cause changes in the blood, converting a part of the hemoglobin into methemoglobin.

Benzoic acid and the benzoates—a class of agents closely allied to salicylic acid and the salicylates—have been highly recommended by Senator and others in the treatment of acute rheumatism. It is claimed for sodium benzoate that it does not disorder the stomach or give rise to the other disagreeable effects following the use of the salicylates. It can be prescribed in doses of from 15 to 20 grains (1.–1.3) every two or three hours. In spite of the favorable reports of a few competent observers, this agent has not come into general use.

*The Alkaline Treatment.*—Whether or not alkalies have a direct effect in

[1] *Practical Therapeutics*, p. 534.

cutting short the course of acute rheumatism is a mooted point. The statistics of Gull and Sutton appear to show that the natural course of the disease when the patient is kept quiet in bed varies but slightly from the course when alkaline treatment has been faithfully carried out. If the evidence in favor of the alkalies, as being useful in cutting short an attack, is doubtful, we have apparently strong grounds for believing that they have some power not only in preventing but also in lessening the cardiac manifestations of the rheumatic poison. This claim is a very important one. The late Dr. Palmer Howard, in his article on "Acute Rheumatism" in Pepper's *System of Medicine*, states, as the result of an able and exhaustive examination into this subject, that in the cases treated with salicylates cardiac complications occurred in 14 per cent., while in those treated with alkalies the proportion was only 7.8 per cent. From these facts he concludes that "It is not improbable that a combination of sodium salicylate with full doses of bicarbonate of potassium will give better results in the treatment of acute rheumatism than either of these classes of remedies alone. Indeed, Flint and others have advised such combination, and Bedford Fenwick has recently stated, as a result of his experience in 30 cases, that if, after giving a free purge followed by 20-grain doses of sodium salicylate hourly for six hours, that salt be stopped and in twelve hours afterward ½-dram doses of the citrate of potassium be administered every four or six hours until the saliva becomes alkaline, relapses will be extremely rare, and that this is the safest and most successful method of treating acute and subacute articular rheumatism."

A great number of other drugs have been recommended in the treatment of acute rheumatism. Potassium iodid, other iodids, opium, quinin, trimethylamin, cimicifuga, actea racemosa, rhus toxicodendron, guaiacum, colchicum, aconite, iron, and different mercurial preparations have all been employed, but at present they are justly considered to belong to the dead past.

**The Diet in Acute Rheumatism.**—In the early stages, the diet should consist of milk, oatmeal-gruel, or barley-water. Animal broths should be carefully avoided. Solid food of any kind, but especially nitrogenous food, should not be taken too early in convalescence. Stimulants are to be avoided, unless there is some visceral complication strongly indicating their employment.

**The Visceral Complications of Acute Rheumatism.**—Under this heading I shall deal chiefly with hyperpyrexia, only indicating in a general way the measures best adapted to counteract the cardiac troubles at their very beginning.

*Pericarditis.*—When pericarditis has set in during the course of treatment, there is practically nothing to be added to the effective general means if we have been treating the case with the salicylates and alkalies. If this combined treatment has not been in use, I believe that it should be at once instituted. The application of a blister to the precordial region is a common practice, whose efficacy it is difficult to prove or disprove. If the pain is severe or the patient restless morphin should be employed, preferably hypodermically. Rest in bed is all-important. The treatment, both medicinal and surgical,

of the products of the inflammatory action will be found under the head of the special article dealing with the treatment of pericarditis.

*Endocarditis.*—When there is evidence of endocardial inflammation, the patient, if not previously under alkaline treatment, should receive full doses of either potassium bicarbonate or potassium citrate. There is no objection to continuing the salicylates. If fever has disappeared I believe it to be good practice to limit the amount of fluids taken by the patient. The administration of chloral two or three times in the twenty-four hours has the effect of lowering the blood-pressure, and thus giving the heart less work to do. The treatment of the pleurisy and pneumonia attending acute rheumatism does not call for special consideration in this article.

*Hyperpyrexia.*—Of all the manifestations or complications of acute rheumatism, hyperpyrexia is the most formidable. I have already referred to the comparative rarity of this condition when treating of the action of the salicylates.

Of the cases of hyperpyrexia collected by the Committee of the Clinical Society of London in the year 1882, it was found that about 80 per cent. occurred during the period 1873–77. The strange and unexplained variation in the proportion of cases of hyperpyrexia at different periods is well illustrated by the further fact referred to by Dr. A. E. Garrod, that for a period of six years (1881–86) only a single case occurred in St. Bartholomew's Hospital.

The onset of hyperpyrexia may be sudden, or it may be preceded by delirium and the other nervous symptoms constituting the symptom-complex of cerebral rheumatism.

There is only one measure of any great value in hyperpyrexia, and that is the application of cold, and it is clear from the general experience on this point that the sooner it is employed the better are the patient's prospects of recovery. The employment of medicinal antipyretics such as antipyrin, phenacetin, quinin, and salicylic acid is in the vast majority of cases not only useless, but positively harmful, as valuable time is thus lost.

In the very able report of the Clinical Society of London it is shown that the temperature cannot safely be allowed to rise above 105° F. (40.6° C.). It may reasonably be concluded that if during the course of an attack of acute rheumatism the temperature suddenly rises from 102° or 103° F. (38.9°–39.4° C.) to 105° F. (40.6° C.), in the absence of any local complication, we have to do with so-called cerebral rheumatism, and the sooner cold is employed the better. The general cold bath is certainly the most effectual means of employing the antipyretic action of cold. In private practice, especially in the country, it may be impossible to do this, but in hospital practice there is no excuse for neglecting it.

If the patient is still conscious, I think it better to employ a bath at a temperature of from 85° to 90° F. (29.4°–32.2° C.), and gradually to reduce the temperature to 65° F. (18.3° C.) or 60° F. (15.6° C.). If, however, there is unconsciousness, the sooner the reduction is effected the better; or the patient may be at once placed in a bath at a temperature of 65° F. (18.3° C.) He

should not be kept longer in the bath than the time required to reduce the temperature to 101° F. (38.3° C.) or 100° F. (37.8° C.). It will generally be found that the temperature goes on falling from 1° F. (0.6° C.) to 3° F. (1.7° C.) after removal from the bath. The first bath always takes longer to reduce the temperature than subsequent ones. When the patient is removed from the bath, he should be rapidly dried and wrapped in blankets and stimulant given.

The time necessary to effect a reduction of the temperature from 107° F. (41.7° C.) or 108° F. (42.2° C.) to 101° F. (38.3° C.) varies greatly in different cases. It will, I believe, be generally found that it can be accomplished in half an hour; it is seldom that more than an hour is required. If the reduction is not effected in an hour, there is no reason why the patient should not be kept in the bath longer, as the measure, in such a necessarily severe case, is the only one that is at all likely to save life.

In some instances, a single bath is all that is required. If the temperature should reascend, a second bath should be given. There is hardly a limit to the number that may be employed. In the Clinical Society's report two cases are mentioned that ultimately recovered in which twenty-six baths were found necessary.

Practically speaking, there is no complication that forbids or contraindicates the employment of cold baths in the reduction of the hyperpyrexia of acute rheumatism. The condition is so grave that it completely overshadows all possible minor dangers from the use of cold. In the statistical information collected by the committee, it is shown that only one case recovered with a temperature higher than 106° F. (41.1° C.) in which the bath was not employed. Of the bathed cases with a temperature of over 106° F. (41.1° C.) nearly 60 per cent. recovered. Several cases are on record in which the temperature reached 110° F. (43.4° C.), and in which recovery has followed the use of cold. Such evidence is conclusive of the very great value of the cold bath in these cases. Often it is not effective, but then we have no means to compare with it. It not only reduces the temperature, but it also subdues the delirium. If the patient has been previously comatose, the mind becomes clear, the pulse is reduced in frequency and increased in strength, and normal sleep returns to relieve the nervous system.

When it is impossible to make use of the general cold bath, we may use cold with success in certain other ways. Sponging the body with ice-cold water or the cold wet-sheet-pack may be made use of.

Prof. H. C. Wood[1] speaks highly of a method of applying cold in the treatment of typhoid fever which is equally applicable to cases of cerebral rheumatism. He says: "When no portable bath-tub is at hand, antipyresis may be had by lifting the patient, wrapped in a sheet, upon a cot covered with a rubber blanket, and sousing rather than sponging him with cold water from a large carriage-sponge. If the sacking-bottom or canvas of the cot be so loose as to sag down several inches, and the rubber blanket be

[1] *Therapeutics, its Principles and Practice*, p. 71.

turned up at the bottom and top over a wide board nailed across the top and bottom, the patient during the sponging lies in a big pool of water, and all the effect of the cold bath is obtained by removing, with a carriage-sponge, this water as fast as heated and sousing fresh cold water (ice-water if necessary) freely over the upper part of the patient."

*Anemia.*—It is a well-known clinical fact that anemia rapidly supervenes during the course of acute rheumatism. Even before the end of the first week it is a prominent feature. It has been recently shown by A. E. Garrod that there is a diminution not only in the number of red cells, but also in their individual value. This condition clearly calls for iron, as soon as the pyrexia has subsided.

### Chronic Articular Rheumatism.

So little is known of the nature of chronic articular rheumatism that its scientific treatment is impossible. The most we can do is to give our patients advice in the way of prevention, and meeting any symptomatic indications.

We have no measures of any special value as internal remedies. Salicylates, quinin, alkalies, potassium iodid, are each and all of comparatively little value, although generally prescribed. Cases are now and then met with in which the salicylates appear to give more or less relief, but it is very questionable whether they have any direct influence. There is no doubt that during the course of chronic rheumatism, there occur regular superadded subacute inflammatory attacks, and in such cases relief would be expected from the salicylates. Some observers speak favorably of the action of ichthyol in chronic rheumatism. This can be administered in the form of sodium or lithium sulpho-ichthyolate in doses of from 10 to 30 grains (0.65–2.). Owing to its disagreeable, tarry odor it should be given in capsules.

**On the Use of Mineral Baths in the Treatment of Chronic Articular Rheumatism.**—From time immemorial the systematic employment of mineral baths has been a favorite remedial measure in the treatment of chronic articular rheumatism. The thermal sulphur and alkaline baths are those most highly prized. It is doubtful whether there is any specific action in either the alkaline or the sulphurous constituents of the various baths employed. In all probability the chief therapeutic virtue resides in the heat and the accessory measures (massage, passive movements, etc.), employed at the various health-resorts.

The most important warm sulphur-baths on this continent are those at Banff, Alberta, Canada. The temperature varies from 93° F. (33.9° C.) to 127° F. (52.8° C.). At this resort there are to be found all the comforts and conveniences afforded by the best-conducted European health-resorts. The Arkansas thermal springs have also a well-deserved reputation in cases of chronic rheumatism. In Virginia and California there are numerous thermal springs, all having at least a local reputation in the treatment of this disease. On the European Continent, the more important thermal sulphur-baths are

those at Aix-les-Bains in Savoy, and Aachen in Rhenish Prussia. The temperature of the water at Aix-les-Bains varies from 112° to 114° F. (44.5°–45.6° C.), and at Aachen from 97° to 110° F. (36.1°–43.4° C.).

At Aachen, according to Brandis, the following is the method usually employed in dealing with chronic rheumatism: In the morning, from three to four glasses of the thermal waters are drunk during the course of an hour. In the intervals the patient is recommended to take gentle exercise. An hour after breakfast a warm bath is taken, and when all tenderness has disappeared the joints are douched with water at the same temperature as the bath, and at the same time they are gently rubbed. Whether the patient takes exercise or rest after his bath depends on his general state and the weather.

The thermal springs of Bath, England, have a well-deserved reputation in the treatment of chronic rheumatism.

Before recommending a chronic rheumatic to use hot baths, a careful examination should be made into the functions of the kidneys and into the state of the heart and circulation. Organic disease of the kidneys, with general arteriosclerosis or hypertrophy of the left ventricle, is a distinct contraindication to the use of the baths. Advanced age, even with healthy kidneys and circulation, is also a contraindication.

**Local Treatment.**—The local treatment of chronic rheumatism consists in the employment of various counter-irritants, analgesics, and alterative agents. As a counter-irritant Osler strongly recommends the use of the Paquelin cautery. Burney Yeo speaks well of small blisters about the size of a fifty-cent piece, applied for a short time over the circumference of the affected joint. They should not be kept on any longer than is necessary to produce redness at the seat of application. When the surface has returned to its normal state, he further recommends gentle friction with the linimentum potassii iodidi cum sapone and gentle passive movements. The simple iodin-liniment is another favorite counter-irritant.

As analgesics, equal parts of liniments of chloroform and belladonna or of chloroform and opium are useful. Ichthyol, aconite, veratrin, are also useful to relieve pain.

**The Hygienic and Dietetic Treatment of Chronic Articular Rheumatism.**—Although but little is known of the nature of chronic rheumatism it is a well-known fact that exposure to cold and damp is its chief exciting cause. Therefore a dry, warm, and uniform climate is the most suitable for chronic rheumatics; but only a very few can avail themselves of the benefit to be obtained from climatic changes. The disease is mainly met with in the poor laborers and cabmen of cities and among the farmers in the country—classes which are unable to make any change. It is possible, however, for nearly all to live in dry and warm houses. Flannel should always be worn next the skin. Attention to these measures constitutes the chief hygienic observance known to be of value. They are preventive rather than curative. The general constitutional treatment should also be a matter of thought. If the patient is in a depressed condition, iron, cod-liver oil, and arsenic are called

for. Through these means we increase the resisting power of the tissues, and therefore lessen the tendency of the articular and periarticular structures to inflammatory involvement. It is important that such patients should be careful to live on good and wholesome food. Some cases do best on a nearly vegetable diet, but, as a rule, I believe it will be found that a liberal meat-diet is essential for maintaining that vigor of constitution which is, after all, the best safeguard against the chronic rheumatic process. Stimulants are best avoided.

# GOUT.

By JAMES STEWART.

Our knowledge of the real nature of gout is still very imperfect. Long believed to be essentially a uricemia, it has been conclusively proved that uric-acid retention and precipitation do not by any means explain the protean manifestations of this remarkable disease. No doubt some of the symptoms are easily explained by uratic precipitation, but many other symptoms, such as the arthritides, cannot be so easily referred to their cause. The attempt is made by some to explain the nature of gout by attributing it to functional derangement of the liver and the kidneys, and degenerative changes in the fibrous tissues; others look upon the affection as being essentially due to some functional nervous changes; but all of these theories are quite inadequate to explain fully the true nature of gout.

Whatever may be found to be the ultimate cause, there is a consensus of opinion that in certain dietetic and hygienic measures we have important means not only of controlling the usual periodic outbreaks, but also, to a certain extent, of preventing them.

The treatment of gout will be dealt with under the following heads: 1. The treatment of the disordered state of nutrition that leads to its development in its many phases. 2. The treatment of the various lesions and functional disturbances that arise from this disordered state of nutrition.

We shall first consider the appropriate dietetic regimen for the gouty to follow—this being, I think, the most important part of the therapeutics of the disease.

**The Diet in Gout.**—In the investigation of a case of gout it is of first importance to inquire very carefully into the patient's usual habits as to eating. Strict rules should be laid down, not only as to the quality but also as to the quantity of food to be taken. In many cases it will be found that there are errors in both directions. Every case requires special study. It is a routine practice to have a stated dietary, as respects both quantity and quality, for a gouty subject. Frequently it will be found that the patient errs more as regards the quantity than the quality of his food. A diminution in the quantity is usually called for in the cases of corpulent patients. In a general way, it is always well to insist on the patient never fully satisfying his appetite.

As to the quality of food best adapted for gouty people, there is a marked difference of opinion. Many consider the albuminous elements as the most injurious, while others look upon the carbohydrates as equally bad. Both of these contentions are in certain cases correct. There can, I believe, be no

doubt that usually we find an excess in nitrogenous elements as the chief factor in cases of gout. Nitrogenous food is a necessity for the vast majority of people. The practice of demanding of a middle-aged man to suddenly change the habits of a lifetime—from a full nitrogenous diet to a strictly vegetarian one—is not wise. It is only in young persons that anything like so radical a change can be effected with safety to the general health. In giving general directions as to the amount of food of nitrogenous character, it is necessary to take into account the patient's occupation and habits, especially as regards bodily exercise. If his work is sedentary and he is disinclined to exercise, the amount of nitrogenous food should be much less than if he is active in body.

Excess of white meats is usually considered to be less injurious than excess of red meats. Fish, oysters, game, and all other varieties of nitrogenous foods should be taken in moderation.

There is considerable diversity of opinion as to the use of fat by gouty subjects. In all probability it will be found that when taken in small quantities it does not tend to increase the disordered constitutional state, but in excess it interferes with the metabolism of the albuminates, and is therefore harmful. In corpulent gouty patients excess of fat would be doubly injurious, as it would interfere also directly with cellular activity. In the case of a corpulent gouty patient, nothing more injurious could well be taken than an excess of all the great food-stuffs. The corpulency is soon increased. In the dietetic treatment of gout it is especially necessary to carefully consider the individual peculiarities of every case. If the general state of nutrition is lowered it will be necessary to allow a fair amount of fat, not only for its nutritive value, but also from the fact that it is not then necessary to give the albuminates and carbohydrates in more than very small quantities. When gastric and intestinal digestion is normally performed fatty food is much better borne than in an abnormal state of the digestive apparatus. As there is a difference of opinion with regard to the advisability of permitting nitrogenous and fatty food, so also is there with regard to the carbohydrates. Speaking generally, I think there exists a well-understood and confirmed opinion in the profession that carbohydrates in excess are more injurious than fat in excess.

In discussing the use of sugar in gout, Sir Dyce Duckworth[1] says: "It is not proved that sugar by itself is harmful to the gouty; but there is evidence to show that if it be freely taken in addition to a varied and mixed diet, especially with certain articles and with wine, an imperfect fermentative process is set up in the stomach and small intestines, which tends to provoke flatulency and acidity. *It is therefore in this manner that sugar proves harmful to those disposed to gout.*"

Ebstein considers sugar distinctly injurious. Senator and Burney Yeo say that if sugar is taken at all, it should be in very small quantities.

As a rule, it will be found good practice to forbid all saccharine fruits in any considerable or regular quantities. There is much discrepancy of opinion in regard to other varieties of fruit. Some maintain that fruits of all and

[1] *Treatise on Gout*, 1889.

every kind, raw or cooked, are suitable (Fothergill, Burney Yeo). Sir Dyce Duckworth, Sir Andrew Clark, Dr. W. H. Draper, and others hold a contrary view. It is difficult to arrive at the truth in the face of such conflicting opinions. That there are cases in which fruits of all kinds act injuriously is a common experience, but I believe that cases are frequently met with in which they do no harm. Provided fruits do not cause any gastric or intestinal disturbance, it is my practice to leave the matter with the patient. If it is found that they can be taken without causing any immediate distress, and they are relished, I believe they can do little harm. If, on the contrary, symptoms of gastric or duodenal dyspepsia follow, they should be forbidden. It remains to be proved in the case of gout that any one of the great group of food-stuffs is in all cases and at all times injurious.

As to the use of vegetables by the gouty, there is more agreement than there is in the case of sugar and fruits. Substances containing oxalic acid, such as sorrel, rhubarb, asparagus, and tomatoes are universally recognized to be harmful. The addition of sugar to such acid vegetables only intensifies their injurious effects. Potatoes, cauliflower, peas, beans, green corn, cucumber, and plain lettuce can be taken, while carrots, turnips, celery, and onions should be avoided.

In discussing the best fluid for those predisposed to gout we come to a difficult subject, and one upon which authorities differ somewhat. Still, on the whole, there are certain well-founded results obtained by experience. It will be almost invariably found in practice that it is easy to recommend certain things, but difficult for the patient to carry out the physician's instructions. It is much easier for the average gouty man to dispense with certain articles of diet than for him to give up entirely his favorite beverage.

It is, I believe, universally recognized that alcohol in all its forms tends to the development of gout when there is the least predisposition. The disease is only rarely met with in those who have always been total abstainers. When called to advise in the case of a young person who has no symptom of gout, but yet has a marked predisposition thereto, it is well to insist strongly upon the advisability or even necessity of absolute temperance in alcohol in all its forms. The same advice is good for all gouty patients, no matter what their age. We occasionally meet with people who believe they are unable to get along without alcohol in some form, and for them we may prescribe alcohol in the form that experience has shown to us to be the least injurious in the gouty. It is impossible for the physician to decide this question; he must be guided by the experience of the patient in himself, finding out what has proved harmless in the past. It is well known that certain forms of alcohol are much more harmful than others; for instance, it is commonly conceded that port wine is of all alcoholic beverages the most likely to bring on a paroxysm of gout. It may do so even in persons who have no hereditary tendency to the disease. The reason for the deleterious action of port wine is the imperfect fermentation, alcohol being added before the process is complete, in order to give it "keeping power." In a general way it may be said that all strong and sweet wines

are bad for the gouty. Champagnes, sherries, Burgundy, Madeira, the different Rhine and Moselle wines, should be carefully avoided. I can from experience fully confirm the statements made by Burney Yeo[1] in reference to cheap claret. He says: "With regard to wines, it is not the name but the quality of the wine which is the most important; and no greater error has ever crept into medical practice than that exceedingly common one of advising every one to drink light claret. A more injurious beverage than bad claret, or imperfectly matured claret—and, speaking generally, all but the more expensive or most carefully selected clarets are bad—was never drunk. Cheap clarets consist of mixtures of the worst and most valueless that are grown on the surface of the globe. Half a glass of bad sherry or claret will produce a decided disturbance of health, when much larger quantities of fine-quality wines will pass through the system without injury." Occasionally we meet with cases in which the rich and sweet wines are well borne. In fact, a case is reported in which champagne and port were considered by a patient—a physician—the best remedy for his gout. If wine is necessary for a patient's comfort or digestion, good Bordeaux will, as a rule, be found to be the best, or rather the least harmful. Beer, porter, and stout are also great enemies to those goutily predisposed, especially when taken daily and in excess at intervals.

E. Pfeiffer[2] has shown the marked influence that both wine and beer have on the elimination of uric acid. He estimated the amount of this acid excreted daily in the urine of persons living under normal conditions and without the use of any stimulants, and found that it varied very slightly from day to day. When he gave his subjects a quantity of either beer or wine at the mid-day or evening meal, he found a marked diminution in the quantity of uric acid excreted, generally to one-half. On the following day it was found to be considerably increased—to a quantity sufficient to make up for the decrease of the previous day. On the next day it was found that the uric acid was again eliminated in decreased quantity and on the next day following a corresponding increase. It is thus shown that the deleterious action of the wine extended over a period of from four to six days. These experiments show the harmful influence of beer and wine on healthy persons. It is a natural inference that in the gouty the disturbance of elimination would be greater.

Ardent spirit is much less likely to precipitate an attack of gout than wine and beer. It is well known that gout is much more frequent in countries where beer and wine are drunk than where whisky, rum, or brandy is the chief beverage.

Alcohol in all forms tends to lessen the elimination of tissue-waste, but from the foregoing facts it is clear that it is not the active factor in the disturbance of elimination met with in the gouty constitutional state. To the acids found in beer and wine must, I think, be attributed this deleterious effect. The administration of acids to persons in good health brings about not only a diminution in the elimination of uric acid, but it also leads to the elimination

[1] *Manual of Treatment*, vol. ii. p. 528.

[2] "Die Natur und Behandlung der Gicht," *Verhand. des Congresses für innere Medicin*, 1889.

of the urates, mainly in the form of uric acid—a condition resembling that of persons suffering from a gouty paroxysm. Good Scotch whisky and French cognac, well diluted with an alkaline water, are probably the safest alcoholic beverages that gouty persons can take. In exceptional cases, even they may be decidedly harmful.

*Milk.*—As a rule, milk will be found to agree well with gouty people, provided it is relished and does not cause gastric or duodenal indigestion. Burney Yeo advises gouty patients to drink, about ten minutes before their first meal, a breakfast-cupful of hot milk and water, to which a small salt-spoonful of potassium bicarbonate and the same quantity of table-salt have been added. He advises skimmed milk, as we in this way get rid of the fat and sugar—the most objectionable constituents.

*Water.*—The very extraordinary differences in professional opinion as to the best beverage for the gouty extend even to water. Very many eminent authorities look upon the free use of water as not only useful but absolutely essential, while others consider water harmful. No less an authority than Sir Dyce Duckworth[1] looks upon water with little favor as a beverage for the gouty. He says: "I feel sure that Sydenham was right in condemning water-drinking for the gouty. Water alone is bad and dangerous, as I know from personal experience. When taken as the regular drink from youth upward it is beneficial. Herein lies a great clinical fact which needs to be duly considered, especially at the present time." The distinguished author does not suggest, what would have been desirable, in what possible way water would be likely to act injuriously.

Dr. Burney Yeo,[2] speaking of the action of water in gout, says: "One of the chief advantages to be derived from a course of mineral waters is, as we have already suggested, the quantity of that most important eliminative agent, *water*, that is ingested, and it is not necessary to resort to a mineral spring in order to consume an adequate quantity of this valuable solvent. No remedy is more valuable and important in the treatment of the gouty diathesis than the regular consumption of a considerable quantity of pure water, and preferably *hot water*. As a diluent and solvent of renal excrementitious matters it is most useful, while in its rapid passage through the system it must dissolve and carry away waste matters from the blood and tissues. When drunk at a higher temperature than that of the blood the effect of this hot water flowing through the hepatic portal circulation is to stimulate the functions of the liver-cells and promote biliary excretion. It thus responds fully to the foremost indication in the treatment of gout—*i. e.* "to promote the elimination of waste; while, by temporarily diluting the blood, it must favor the solution of uratic deposits and prevent their precipitation."

It appears to me that water, provided it be not taken in too large quantities with or shortly after meals, so as to disturb digestion, fulfils, as laid down by Yeo, the first important indication in the treatment of gout—the elimination of waste matters.

[1] *Treatise on Gout*, p. 425.

[2] *Manual of Treatment*, p. 519.

*Tea, Coffee, and Cocoa as Beverages in Gout.*—Tea, coffee, and cocoa can usually be taken with impunity by the gouty, provided little or no sugar be used. In some persons these beverages may induce dyspepsia, and then they will indirectly prove harmful.

*On the Use of the Different Natural Mineral Waters in the Treatment of Gout.*—Next in importance to dietetic measures comes the use of certain mineral waters in the preventive treatment of gout. It will be convenient in this connection to consider also the various auxiliary means used at bathing establishments in the treatment of the gouty constitutional state.

Nearly all the different varieties of mineral waters are or have been recommended in the treatment of gout: the alkaline, the saline, the alkaline and saline, the sulphurous, the bitter-acidulated, the bromo-ioduretted, the indifferent, and the ferruginous waters.

Before deciding which water to employ it is necessary to study each case very carefully. In all probability the alkaline and saline waters meet more indications than any of the others, but cases do occur in which any one of those mentioned may be the most appropriate. Pfeiffer considers that of all alkaline waters, those at the Fachingen springs are the best for gout. They contain 3.5 per cent. of sodium bicarbonate and 6 per cent. of calcium bicarbonate—a greater percentage of these salts than any other known water. They are pleasant to the taste, readily tolerated by the stomach, and, what is of considerable importance, cheaper than any other water.

The Carlsbad waters in Bohemia have acquired a great reputation in the treatment of gout, especially in robust and corpulent patients. They can be used with advantage at home, but to secure the best results it is necessary to take a "regular course" at Carlsbad. It is only in this way that the full benefits can be obtained from the combined hygienic, dietetic, and hydrotherapeutic regimen. There can be no doubt that the strict dietetic and hygienic measures enforced here and at similar places constitute an important factor in the successful results. Carlsbad waters contain principally sodium sulphate, carbonate, and chlorid. They are thermal waters, the temperature of the different springs varying from 120° to 130° F. (48.9°–54.4° C.). The imported waters may be taken on rising in the morning, in doses of from 4 to 5 ounces (120.–150.) in an equal quantity of warm water. They have a mild aperient action. They should be used with great caution by patients having any degenerative changes in the kidneys, heart, or arteries. A course at Carlsbad extends over three weeks, and it is the usual custom of the physicians resident there to recommend gouty patients to take two courses every year for three successive years.

The Marienbad waters have also a great reputation in the treatment of gout in the robust and corpulent. Their chemic composition differs but slightly from that of the waters of Carlsbad. They are, however, not thermal waters. The amount of sodium sulphate is considerably greater in the Kreuzbrunnen than in any of the Carlsbad waters. This may be an advantage in some cases, and a distinct disadvantage in others. It is all-important that patients before using

the baths or drinking the waters at Marienbad should consult a local physician. The injudicious employment of the waters may do much harm. This is of course much more likely to happen in elderly people or those with degenerate vessels or damaged kidneys.

Vichy may also be taken as a type of a purely alkaline water. It is considered to be also of particular value in the gouty constitutional state. The same precautions should be attended to when using these waters as with the Carlsbad and Marienbad waters. Vals water is especially indicated in those cases in which the tendency to uric-acid formation in excess is marked.

In the United States and Canada there are several alkaline-saline mineral waters of importance. The best known are those at Saratoga in New York State. Besides sodium chlorid and the alkaline carbonates, they contain carbonic acid, which renders them agreeable. The St. Clair spring in Michigan and the Caledonia and St. Catherine springs in Ontario are also useful alkaline-saline waters. The indifferent waters of Bath and Buxton in England are indicated and employed with benefit in the gouty constitutional state. The sulphurous waters of Aachen have also a reputation in gout.

*Climate and Exercise.*—Gout is a disease rarely found in warm climates. This is in great part owing to the non-nitrogenous character of the diet, but also to some extent to the temperature itself. It has been found that a change from a cold to a warm climate proves distinctly beneficial to gouty people. The discomforts naturally attending travelling often prove of benefit to gouty patients, who are, as a rule, strongly inclined to domestic comforts and who are often lacking in the energy necessary to travel. If not able to leave their homes, they should be urged to take considerable and regular exercise. Regular exercise promotes metabolism and secures the proper performance of the functions of the different eliminating organs. When exercise is not possible, massage should be resorted to. Regular mental work is also a matter of considerable importance.

**Medicinal Treatment of the Constitutional State in the Gouty.**—In addition to the dietetic and general hygienic measures referred to, we have in certain medicinal compounds means whereby we can in very many cases favorably influence the gouty constitutional state. It is, however, the duty of the physician to clearly lay before his patient the fact that his safety lies essentially in a strict adherence to those forms of diet, etc., that have been sketched out; and that drugs are at best only aids—and for the most part only meeting certain special symptomatic indications.

Of all drugs, the alkalies are, I believe, the most useful. They promote metabolism and also tend to prevent the deposition of uric acid. The former is, however, their chief action. To this end salts of potassium, sodium, and lithium are all employed. There is no good reason for believing that the salts of lithium have a special value, as was formerly taught. There appears to be no doubt that their special use has been greatly overestimated. Burney Yeo recommends a mixture of the various alkalies as being more effective than any one separately.

The natural lithium mineral waters contain the alkali in too small amount to be of any particular medicinal use. The salts of lithium have, therefore, to be prescribed. The benzoate, carbonate, citrate, salicylate, hippurate, and guaiacate are all suitable for internal administration. The benzoate can be administered in doses of from 5 to 20 grains (0.32–1.3) in water with sirup. The average dose of the guaiacate, carbonate, and citrate is about 5 grains (0.32); that of the salicylate and hippurate about 10 grains (0.65). The granular effervescent salicylate in teaspoonful-doses is an agreeable form for the administration of this alkali. The hippurate may be prescribed as follows:

℞ Lithii hippuratis, ʒj (4.);
Syrupi aurantii, fʒj (30.);
Aquæ, q. s. ad fʒvj (180.).—M.
S. A tablespoonful in water at bed-time.

As a rule, it will not be necessary to give any alkali oftener than once in the twenty-four hours, and preferably at bed-time. When it is desirable to give an alkaline agent more frequently, the remaining doses should be given well diluted and before meals.

The salts of potassium may be given in the form of the bicarbonate, nitrate, carbonate, or citrate, and the salts of sodium as the carbonate or bicarbonate.

Potassium iodid is an agent of value in gout. There is a general consensus of opinion as to its value in retarding arterio-sclerotic changes. The dose should, as a rule, not exceed 30 grains (2.) in the twenty-four hours. The drug should not be given in quantities sufficiently large to quicken the pulse, as otherwise the desired effect will be in a great measure frustrated. I believe that this salt acts mainly by lowering the blood-pressure. From an investigation into its action in a considerable number of cases I am convinced that it has little or no diuretic action.

Frequently it will be found that iron in some form is indicated in the treatment of the gouty constitutional state. These indications are the existence of anemia and albuminuria. In the form of the natural ferruginous waters iron is especially useful, and the more so when we have a combination of alkaline and saline ingredients. The Pyrmont waters may be taken as a type. They contain iron in the form of the bicarbonate, together with magnesium, potassium and sodium sulphates, and small quantities of lithium, sodium, and ammonium chlorids. When the Pyrmont waters are not available, iron may be given in a form that somewhat resembles the ingredients of the waters—*i. e.*, small quantities of iron with a sufficient amount of the purgative alkalies to prevent the constipating effect of the salts of iron. The following combination practically fulfils this indication:

℞ Ferri sulphatis, gr. xij (0.78);
Magnesii sulphatis, ʒj (32.);
Infusi calumbæ, q. s. ad fʒvj (180.).—M.
S. A tablespoonful to be taken once or twice daily.

When giving ferric salts in gout they should always be combined with purgatives; otherwise an acute attack of gout may be induced.

Another hematinic of great value in the anemia and albuminuria of gout is arsenic. It has in addition to its hematinic action a powerful influence in promoting metabolism. It can be prescribed either in the form of Fowler's solution or as arsenous acid.

Piperazin, which on its introduction into therapeutics a few years ago was considered by many to be of great value in the gouty constitutional state, has been found to be of comparatively little use.

For the constipation so frequently present in the gouty, I have found the following pill very efficient:

℞ Extracti cascaræ sagradæ,
Extracti aloes Socotrinæ, āā gr. j (0.065).—M.
S. One such pill every night.

Iridin will also be found useful in combination with aloes. The occasional administration of some natural bitters in the morning is also to be recommended.

The more remote functional and organic troubles indirectly met with in the gouty will be better considered under their usual headings.

**The Treatment of the Acute Gouty Paroxysm.**—The most frequent and often the most troublesome external local manifestation of the gouty diathesis is the acute arthritis. The indications do not essentially differ from those of any other form of acute arthritis. Rest is of the first importance. The limb should be elevated. Occasionally, writers even of the present time recommend that a gouty patient should "walk off" his inflamed gouty joint. This, however, is seldom possible and never desirable. It is an attempt to treat the constitutional state when it is too late, as far as the present attack is concerned.

For the relief of the acute pain various anodyne agents may be used. Sir Dyce Duckworth speaks approvingly of the following:

℞ Atropinæ, gr. iij (0.19);
Morphinæ hydrochloratis, gr. xv (1.);
Acidi oleici, f℥j (30.).
Solve et fiat linimentum.
S. To be painted over the painful joint with a large camel's-hair brush, and carded cotton to be superimposed, with a towel bandage.

The following ointment has been recommended by Charcot:

℞ Extracti opii, gr. xlv (3.);
Extracti hyoscyami, ʒjss (6.);
Adipis, ℥j (32.).
M. et fiat unguentum.
S. Apply to the painful joints and then cover with cotton-wool.

Garrod recommends the following as being effective for temporary relief:

℞ Linimenti belladonnæ, f℥iij (90.);
Morphinæ hydrochloratis, gr. x (0.65).
M. et fiat linimentum.
S. A teaspoonful to be mixed with a tablespoonful of hot water and applied on lint under oiled silk every four hours.

Ichthyol, cocain, menthol, and camphor-chloral are also of value as local analgesics. Frequently warm applications are found to be more effective than the local analgesics. Cold applications should not be used. Local bloodletting, formerly much employed, is now seldom used. Nothing is to be gained by the application of blisters around the inflamed joints.

**Internal Treatment of Acute Gout.**—There is no unanimity of opinion as to the value or non-value of medicinal agents in acute gout. Some maintain that much can be accomplished in this way, while others hold the opposite opinion. Colchicum is a drug that has been used in the treatment of gout for a very long period. The testimony in its favor appears to be overwhelming; still, there are many competent observers who say that it has little or no beneficial action. The wine of the root is the preparation usually employed in gout. The wine and the tincture of the seeds are also efficient preparations; they have, however, a more irritating effect on the gastro-intestinal mucous membrane than the former. The dose of the wine of the root varies from 10 to 30 minims (0.62–1.85). The usual method of administration is to begin with a dose of 20 minims (1.23) and continue till either relief is obtained or irritant effects on the gastro-intestinal canal are brought about. It is doubtful if it is either necessary or desirable to bring about the latter effects in any case. Lauder Brunton looks upon colchicum as being more active when combined with purgatives or when the bowels have been previously well moved. He recommends the following combination:

℞ Vini colchici, f℥ss (15.);
Magnesii carbonatis, ℥j (4.);
Magnesii sulphatis, ℥ss (16.);
Aquæ menthæ piperitæ, q. s. ad f℥vj (180.).—M.
S. A teaspoonful to be taken every four hours while the pain is troublesome.

Many different hypotheses have been advanced to explain the mode of action of colchicum in gout. That it acts mainly by promoting the secretory activity of the chief eliminating organs is a favorite view with many. Another view is that its value is chiefly owing to its depressant action on the circulation. Still others are that it influences hepatic metabolism; that it inhibits the action of the ferments that give rise to the production of uric acid; that it benumbs the sensory nerve-endings in the joints and fibrous and muscular structures, so that the irritation induced by uric acid is not felt by the patient. Still another view is that it has a direct antidotal action on the cause of the arthritis—that, in other words, it is a specific in the same sense as is quinin in malarial fever

and the salicylates in acute articular rheumatism. In the present state of our want of knowledge of the true cause of gout it is impossible to determine how colchicum acts. In all probability its action varies in different cases. A point, however, of importance is that its usefulness is frequently demonstrated without any noticeable depressant action on the heart or any distinctly irritating effects on the eliminating organs.

*The Salicylates in the Acute Arthritis of Gout.*—Some observers consider the salicylates as fully equal in value to colchicum in relieving the pain of acute gout. Sir Dyce Duckworth says that salicylic acid does not always afford relief so rapidly, even when successful, as does colchicum; and not for a day or two is its efficacy appreciated, at all events by the patient. In some cases, however, it acts promptly and decidedly. He does not think salicylic acid likely to supersede colchicum as a prompt deliverer from the agony of a gouty paroxysm. When prescribed, the salicylates should be given in the same full doses with which we are accustomed to prescribe them in acute rheumatism.

*The Alkaline Treatment of Acute Gout.*—The different alkaline agents have an undoubted influence not only in relieving the pain of gouty arthritis, but also in lessening the amount of uric acid. With many it is a usual practice to combine alkalies with colchicum. Certain popular nostrums for gout are combinations of alkalies, salicylic acid, and colchicum. Garrod strongly recommends in the subacute stages a combination of quinin with the alkalies.

Guaiacum, the benzoates, potassium iodid, manganese, trimethylamin, veratrin, and many other medicinal agents have been recommended as useful in affording relief from the gouty paroxysm, but all are inferior to those already mentioned.

*The Dietetic Treatment of Acute Gout.*—The diet should, as a rule, be such as is suitable in acute febrile affections—milk, milk and soda-water, thin oatmeal gruel, whey, etc. In elderly persons with deficient resisting powers, tea, fish, and weak animal broths may be allowed in addition to the milk-diet. It is necessary to partially restrict the diet also during the period of convalescence from the attack. The cases are exceptional indeed in which it is necessary to give stimulants during the acute attack.

**The Local Treatment of Subacute and Chronic Gouty Arthritis.**—During the subacute and early chronic stage of a gouty arthritis more or less pain is present on movement of the joint. No active measures should be employed. The subsequent stiffness may be greatly relieved by the local application of iodin, or of the linimentum potassii iodidi cum sapone, together with general passive motion, and friction.

The uratic deposits found in various parts in the very chronic forms of gout do not call for any special treatment. As a rule, they should not be interfered with. If they break down, they should be dealt with on general surgical principles.

## Retrocedent Gout.

The term "retrocedent gout" is applied to those symptoms that suddenly supervene on the abrupt subsidence of a paroxysm of acute gout. No satis-

factory explanation has as yet been given of their nature. The most common states encountered are violent pain in the stomach, vomiting, and great prostration. Such attacks have proved fatal. They were formerly thought to be due to the influence of cold, and cases have been recorded in which they have followed the use of cold applications to the inflamed joints. It is still held by many that the best treatment for such cases is to apply irritating and hot liniments to the joint, so as to re-establish the arthritis.

# RHEUMATOID ARTHRITIS; GONORRHEAL ARTHRITIS.

By JAMES STEWART.

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## Rheumatoid Arthritis.

Within a comparatively recent period the views as to the value of treatment in this disease have undergone considerable modifications. It is still commonly taught that there is no hope for cure in any of these cases, once the disease has fairly been established. I believe that when marked articular changes have occurred, there is little hope of doing more than giving relief. What I would like to insist on is that too frequently the disease is not diagnosticated early—often not till the characteristic joint-changes have set in, and then it is too late. If the disease is diagnosticated before such changes supervene, as I believe it frequently can be, then appropriate treatment will probably prevent further changes.

It is first of all of prime importance to ascertain the chief causes that are at work in any given case. Rheumatoid arthritis is a disease essentially dependent on agencies that tend to lower the general constitutional state, and, as such, calls for measures the reverse of those used in acute rheumatism and gout.

The treatment of rheumatoid arthritis with measures of a debilitating character is accountable for the absolutely unfavorable prognosis usually entertained by authorities in the past. In making an early diagnosis of rheumatoid arthritis it is essential that a most careful scrutiny be made into the patient's past history. The disease is in the first place much more frequent in the early period of degenerative life than at any other. When it occurs before thirty it will, I think, be almost invariably found that marked depressing influences are at work. Constantly there are to be found long periods during which the patient has been subject to great care and worry or great physical exertion, or perhaps both physical and mental causes combined. I have seen numbers of cases in young women who have had the care of a bedridden mother or sister. The frequency of the disease at the climacteric period of life is well known. Ovarian and uterine disease is frequently met in such cases. The causation is in all probability an indirect one—the uterine disease, by bringing about a lowered state of health, predisposing to the rheumatoid arthritis. Traumatism no doubt plays a causative rôle in some cases, by depressing the general nervous system and also the tissues subsequently invaded by the chronic inflam-

matory process. Cases are on record in which a sudden, severe mental shock has been the essential cause in lowering the vitality. The influence of cold and damp is of importance also, but probably indirectly by lowering the resisting power of the tissues.

In the treatment of rheumatoid arthritis the first step is to endeavor to combat, when this is possible, the cause or causes at work in inducing debility; secondly, our great aim should be to increase the resisting power of the system; thirdly, attention should be directed to the symptomatic indications.

Sometimes a great deal can be done in meeting the first indication; sometimes very little. If there is present any disease or influence that tends to debility, it should, if possible, be removed. It is important to attend to any uterine or ovarian disease.

We have considerable means at our disposal for meeting the second indication—increasing the resisting power of the body. Cod-liver oil deservedly holds a high place in this connection. A good custom for patients presenting any symptoms of rheumatoid arthritis is to take cod-liver oil during the winter for several years in succession. Next to cod-liver oil, arsenic is probably our most useful drug. The well-known hematinic action of this agent is probably the chief factor in its usefulness. It is, however, a drug that should not be given in the advanced stages of the disease. As pointed out by Charcot,[1] Howard,[2] and others, arsenic often proves injurious in advanced severe cases. It often revives pains that have long been dormant, and not infrequently gives rise to redness and swelling. This drug can be given in the usual form of Fowler's solution, or as liquor sodii arsenatis. Arsenical baths are of doubtful value, for it has been shown by Charcot that arsenic is not absorbed into the blood in this way. Iron, next to arsenic, is a favorite agent. When anemia is present, iron may be given alone or in combination with arsenic. The three agents referred to, viz. cod-liver oil, arsenic, and iron, are the more important medicaments used to increase the resisting power of the tissues toward the disease.

As fulfilling the same indication, it will now be appropriate to consider the hygienic and dietetic treatment of rheumatoid arthritis.

**Hygienic and Dietetic Treatment.**—The diet should be generous and as varied as possible. Animal food is especially indicated if there is no dyspeptic trouble. An exception should, however, be made when acute or subacute attacks are superadded to the chronic arthritis. For some days then it may be wise to limit the amount of nitrogenous food. Stimulants may be allowed, but it is necessary to lay down strict rules as to the quantity. This should not exceed that necessary to aid digestion. If the patient is sleepless, a glass of whisky, well diluted, may also be given at bed-time. Speaking generally, the more liberal the diet the better. Naturally, every case must be carefully studied. There should be no senseless routine treatment. Moderate outdoor exercise I look upon as being beneficial. On account of the tendency of these patients to perspire easily, flannel should be worn all the year round. Undue

[1] *Lectures on Senile Diseases*, p. 222. [2] Pepper's *System of Medicine*, p. 98.

exposure is necessarily bad. The same remarks apply in this connection as in cases of chronic articular rheumatism. The patient should live in a dry dwelling. No doubt living in a warm, dry climate is a great advantage.

It is very unlikely that we have any drugs or any means whatever that exercise a directly favorable influence in arresting the chronic inflammatory process. Some look upon the salicylates as having a more or less directly beneficial action. Palmer Howard[1] says: "Judging from my own late experience and from the results obtained by Sée and other French physicians, sodium salicylate, given in sufficient doses, promises to be more generally useful in the more acute forms or in the actively inflammatory periods and exacerbations of the disease than any other agent. Including Sée's cases, Compagnon has related seventeen examples of rheumatoid arthritis, most of them of the general progressive form, in which great improvement as regards pain, stiffness, swelling, and even deformity, promptly followed the employment of that salt, even after the failure of other remedies. It proved signally useful recently in a rebellious case of my own. . . . It is hardly necessary to say that it often fails in this intractable disease, but it has frequently relieved the pain and swelling, and arrested the progress of it, at least for the time, even when alkalies, iodin, and arsenic had failed." These statements I believe refer rather to acute and subacute attacks of arthritis engrafted on the chronic arthritis than to ordinary cases of chronic progressive rheumatoid arthritis. In the latter it is very rare indeed to find any benefit whatever attending the use of the salicylates.

Iodin and the various iodids have been and are still highly recommended by many physicians. Iron iodid is considered to be of especial value. It is probable, however, that its usefulness depends mainly on the iron and not on the iodin. It therefore belongs to the category of agents referred to as being of value owing to their action in improving the general state of nutrition.

Ordinary alkaline treatment appears to be of little or no benefit. In a disease of such an intractable nature, it is no wonder that a very numerous list of alleged remedies have been recommended. Quinin, cimicifuga racemosa, fraxinus excelsior, mercury, colchicum, and many other drugs have been and are still recommended as being useful. From what we know of the nature of the disease it appears clear that there is no remedy that can be said to have any direct influence upon its course.

There remain to be considered two general measures of some importance—viz., electricity and certain mineral baths.

*Electricity.*—Both the galvanic and faradic currents are employed, and both are used with a double object: first, to influence the general nutritional state; and, secondly, to affect favorably the articular lesions. Remak and M. Meyer were among the first to use galvanism for its general action. The latter asserts that he succeeded in arresting the progressively downward tendency in several cases by galvanization of the sympathetic. Erb, on the other hand, considers galvanization of the spine as more efficient than galvanization of the sympa-

[1] *Loc. cit.*

thetic; although he has not seen any absolute cures follow either method, he has often remarked that the general nutrition is improved and the local changes favorably influenced. When the changes are confined to the upper extremities he passes the current through the cervical cord, and through the lumbar cord when the lower limbs are mainly involved. Daily sittings of from fifteen to twenty minutes are recommended.

Dr. A. E. Garrod, in his recent work, quotes the experience of Dr. Steavenson with the electric bath in the treatment of rheumatoid arthritis. He uses a bath-tub made of some non-conducting material, as wood or porcelain, and has it filled with water at about the normal temperature of the body. A copper plate connected with the negative pole is placed at the foot of the bath, and a similar plate at the head is connected with the positive pole. A galvanometer measuring at least 250 milliampères is used. A current-strength of about 200 milliampères being employed, it is computed that about 210 pass through the body. The duration of each sitting is about ten minutes. During the first six days a daily bath is given, and afterward one on alternate days until the course decided upon has been given. Dr. Steavenson cites several instances in which such baths had a marked influence for good.

*Thermal Baths in the Treatment of Rheumatoid Arthritis.*—Both natural and artificial thermal baths are employed with more or less success in the treatment of rheumatoid arthritis. The former, as a rule, are to be preferred, as the general regimen and hygienic conditions enforced at bathing-places are factors of great importance in the relief frequently gained. The success appears to depend mainly on the temperature and not on any special ingredient of the water; therefore all kinds of thermal waters are employed—the indifferent as well as those containing various salts. The practice very common in this country of patients resorting to Turkish-bath establishments without medical advice is one I have seen on numerous occasions followed by harm. As already especially insisted on, any agencies that tend to depress the constitutional state prove injurious.

At Aachen, in Germany, special attention is paid to the treatment of rheumatoid arthritis by means of douches and massage in conjunction with general thermal baths. Rademacher has found marked benefit to follow this treatment even in advanced cases. In all cases it is found that a temperature of 95° or 97° F. (35°–36.1° C.) should not be exceeded, on account of the tendency of the higher temperature to weaken the patient and increase the tendency to cutaneous perspiration. Douches and massage are only employed when the joint-affection is in a quiescent state. I have seen many cases of rheumatoid arthritis made distinctly worse by the injudicious work of an ignorant masseur or masseuse.

Douches are considered to be of especial value in the monarticular forms of the disease. What is known as the Scotch douche may be used at times with benefit. This consists in the alternate application of hot and cold water to the parts. It can be readily understood that the action of such a powerful means must be carefully watched, and if found not beneficial at once, it should

be discontinued. In employing thermal baths it is a good rule to counsel the patient not to take them oftener than every other day, and not to exceed in all fifteen or twenty. It is not unusual to meet with a slight increase in the joint-pain after a few baths. If this be slight it can be disregarded, but when the pain is decidedly worse, especially if there is such an increase at night as to prevent sleep, I would strongly advise that the bathing should be discontinued. It is impossible to tell beforehand how a patient is likely to be affected by the baths, and it is important to note from the very beginning individual peculiarities. Some patients are soon and greatly benefited; others are quickly made worse. Between these two extremes are all possible degrees of difference.

In many cases the greatest relief is to be obtained by the use of the thermal alkaline waters. Exceptions are not uncommon in which the thermal sulphurous or indifferent baths are the most useful. No definite rules can therefore be laid down for the waters best adapted for all cases.

The thermal waters of Wilbad, Carlsbad, Wiesbaden, Töplitz, and Aix-les-Bains on the Continent of Europe, those of Bath in England, and of Arkansas, Virginia, and Banff in this country may be recommended. If anemia and debility are marked, the patient should be advised first to spend some time at a chalybeate spring, such as Langenschwalbach, Rippoldsau, Spa, and Franzensbad.

### Gonorrheal Arthritis.

The intractable nature of this disease is universally recognized.

**Local Treatment.**—Osler points out the importance of careful local treatment. For the pain and swelling he considers the thermo-cautery the most efficient measure. In the acute form the usual treatment of an arthritis should be fully carried out. This includes rest, position, and counter-irritation, preferably in the form recommended by Osler, the thermo-cautery. In the more chronic forms it is advisable to employ passive motion to prevent ankylosis. In the suppurative form, surgical measures must of necessity be resorted to.

**Internal Treatment.**—We have probably no internal agent of any particular value in subduing the arthritis of gonorrhea. Mercury is probably the most efficient that we possess. The salicylates and the alkalies are usually worthless. Quinin is equally ineffective. A general supporting treatment with food and drugs forms, after all, probably the most reliable general measure that can be made use of.

# RACHITIS (RICKETS).

By JAMES STEWART.

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The real nature of rickets is still an unsolved problem. It is recognized that impure air, deficient sunlight, and insufficient and badly cooked food are potent factors in its causation. Cases, however, do occur in the children of wealthy parents in which the causes named are not in operation, and it must be concluded that there is some additional cause at work. What this is is, however, unknown. A common hypothesis advanced is that the affection is due to a deficiency in lime-salts. The changes in the bones are either of an inflammatory or pseudo-inflammatory nature, but whether this state is primary or is secondary to a more deeply seated change in nutrition is a mooted question. It would serve no useful purpose in this article to discuss or even mention the numerous theories advanced and in vogue at the present time to explain the pathology of rickets.

**The Preventive Treatment of Rickets.**—The preventive treatment has, in the first place, to do mainly with the mother's health. It is well known that a syphilitic mother is likely to bear not only syphilitic but also rachitic children. It is therefore of great importance to institute careful antisyphilitic treatment during the course of pregnancy if there be any suspicion that the mother is infected. Perhaps two or more courses of mercurial treatment may be called for during the continuance of pregnancy. The general health of the mother, whether syphilitic or not, should be carefully guarded. A good, wholesome, generous diet is, above all other things, of importance. Milk should form a constant article of the mother's food. Medicinal agents may or may not be necessary. Plenty of fresh air is certainly of great moment also. Should the mother be nursing an infant when pregnancy begins, the child must be weaned.

**The Direct Treatment of Rickets.**—*Food.*—Proper food for a child that presents signs of beginning rickets is all-important. If the child is nursed, it is necessary, in the first place, to learn whether or not the milk is sufficient in quantity and proper in quality for its needs. If found deficient in either direction, artificial feeding should partially or wholly replace the mother's milk. The substitution should, as a rule, be effected gradually. For the great majority of rachitic infants the best substitute for mothers' milk is cows' milk suitably prepared. It is not necessary here to deal with the entire subject of the artificial feeding of infants. This will be dealt with more especially in the appropriate section. There is nothing special in the subject as it relates to rickety children.

*Hygienic Surroundings, etc.*—During the winter months, the rachitic child should, if possible, be warmly but not too heavily clad, woollen underclothing being essential. It is, of course, necessary that the best sanitary surroundings possible should be secured. Unfortunately, it is but seldom that the poor parents of rickety children can command even decent apartments, let alone completely sanitary ones. In the summer, fresh air, if obtainable, is to be recommended. There can, I think, be no doubt about the markedly beneficial influence of a stay at the seaside or in a mountainous region.

A point of importance is to prevent a rachitic child from acquiring a habit of assuming too frequently the same posture, in order to avoid the supervention of deformities. For the same reason, too early attempts at standing or walking should be discouraged.

Care should be taken that the rachitic child is not exposed in damp weather or to cold winds. The great tendency to catarrhal affections should ever be borne in mind.

*Baths in the Treatment of Rachitis.*—The employment of different forms of baths plays an important rôle in the treatment of rickets. The following different forms of baths may be used with advantage in different cases and in different stages of the disease: (1) A bath of simple water, chiefly for the purpose of cleanliness. For children under six months the temperature of the water should usually not be below 90° F. (32.2° C.). Gentle friction should be employed, especially upon the extremities, after removal from the bath and drying. (2) Different forms of medicated baths can be used with advantage. Certain saline ingredients, such as rock-salt or sea-salt, may be added to the warm bath once or twice weekly. If there is anemia the addition of iron, with or without salines, is of value. Iron sulphate may be used for this purpose. Sun-baths and sand-baths at the seaside are particularly recommended by certain German authors.

*The Medicinal Treatment of Rickets.*—We have no agent that can be said to have a direct effect in checking the progress of the disordered nutrition. For some years it was claimed by certain observers that phosphorus had such an influence, but recent work in this direction makes this highly improbable. The phosphorus-treatment of rickets has long been known, but it was little thought of till a few years ago, when Kassowitz strongly advocated its employment. He looks upon the disturbance in rickets as being due to a chronic inflammatory process in the osseous tissue, and he claims that phosphorus lessens the hyperemia by restricting the growth of the vessels.

He prescribes the drug as follows:

℞ Phosphori, 0.01 (1/6 gr.);
Solve in Olei amygdalæ dulcis,
vel Olei olivarum, 10.00 (f℥iiss);
Pulv. gummi arabici, 5.00 (gr. lxxv);
Syrupi simplicis, 5.00 (♏lxxx);
Aquæ destillatæ, 80.00 (f℥iiss).—M.

S. A teaspoonful daily.

Or,

℞ Olei morrhuæ, 100.00 (f℥iiiss);
Phosphori, 0.01 (gr. $\frac{1}{6}$).—M.
S. A teaspoonful daily.

Many different observers have reported the results of their use of phosphorus since the publication of the memoirs of Kassowitz, and on the whole it must be admitted they do not confirm the hopeful results originally reported. In America, Jacobi has used the drug extensively and with beneficial effects. He does not recommend more than gr. $\frac{1}{200}$ (0.00032). Even this, I think, is a large dose. It is always well to begin with the very smallest doses—gr. $\frac{1}{500}$ or $\frac{1}{400}$ (0.00013–0.00016)—and gradually increase till gr. $\frac{1}{200}$ (0.00032) can be taken without gastric disturbance. In the absence of a better remedy phosphorus is, I believe, worthy of a trial. It should be administered on a full stomach. If it gives rise to the slightest gastric disturbance, it should be at once discontinued.

Cod-liver oil has long held and still holds an important place in the therapeutics of rickets. In children under a year old, cod-liver oil should be given in emulsion, but older children can usually take it pure. It is to be understood, however, that no advantage is gained from this or any other agent if it disturb digestion.

Iron is often indicated in rickets to improve nutrition. There are numerous preparations to choose from, the ferrous salts being preferable to the ferric. The sirup of the iodid is a favorite preparation, as is also the syrupus ferri phosphatis compositus.

Calcium phosphate is another agent highly recommended in the treatment of rickets. It is given with the idea of supplying the deficiency in lime-salts which is one of the characteristics of the perverted bone-nutrition of the disease. It can be given in doses of 2 or 3 grains (0.13–0.19) to a child a year old. Sirup of calcium lacto-phosphate is considered by many to be quite as efficient as the phosphate. Fruitnight, in a paper read before the American Pediatric Society in 1893, gives details of a number of cases in which the lacto-phosphate appeared to be useful.

It is always difficult in a case of rickets to estimate the relative value of medicinal agents as compared with an improved diet and hygienic surroundings. It is an established fact that rickety children usually improve with the latter alone, and go on usually to complete recovery—as far as recovery can be called complete in rickets.

# OSTEOMALACIA.

By GEORGE DOCK.

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As the possibility of successfully treating osteomalacia depends on timely diagnosis, it is important that the early symptoms of the disease be borne in mind. In the later stages, when softening, fractures, and deformity are far advanced, the differential diagnosis between osteomalacia and carcinoma, sarcoma, myeloma, or other bone-disease may be a matter of considerable interest, but of very little value to the patient except in so far as palliative treatment is concerned. Experience shows that not only in America, where the disease is rare, but also in localities where it is comparatively frequent, osteomalacia in its early stage is most frequently mistaken for rheumatism, less frequently for neuralgia, rheumatoid arthritis, or some disease of the spinal cord. The differential diagnosis between rickets and osteomalacia rarely comes under consideration. It is based on the age of the patient, the absence of the characteristic shape of the skull, of swellings of the epiphyses and of widespread pain in the bones. The other sources of error are to be excluded by a careful anamnesis and a thorough examination of the body, with special reference to the pain in the bones, especially in the pelvis, back, and legs, and the important symptom of yielding to pressure on the part of the iliac bones. Vaginal and rectal examination should also be made in order to be certain as to the condition of the pelvis. Prolonged observation while carrying out symptomatic treatment will be necessary in many cases before the precise diagnosis can be established, an exacerbation at the menstrual periods being an important sign.

The treatment of osteomalacia may be divided into prophylactic, curative, and palliative, according to the condition of the patient. Prophylactic treatment is applicable to patients who have shown symptoms of the disease, but have recovered, and in whom a return of the symptoms may be expected. This is true of puerperal osteomalacia, the milder forms of which, called by Fehling "physiologic osteomalacia," are perhaps more frequent than has hitherto been suspected. The hygienic conditions of such patients must be made as perfect as possible, clothing, dwelling, and food being carefully investigated and needed improvements enforced. Sunshine, fresh air, and bathing are important desiderata. As regards diet, those substances that contain a large proportion of phosphorus and lime are generally preferred—milk, eggs, fresh meat, fish, beans, peas, and cereals being most useful. Potatoes should be avoided. Tonics, such as iron, cod-liver oil, strychnin, or cinchona, are often useful. The advice usually given in such cases, to avoid conception,

frequently fails in its object. When conception occurs, if the symptoms of the disease are marked, early abortion is sometimes necessary. Sometimes, however, by careful treatment pregnancy may be allowed to go on to term, the probable necessity for Cesarean section having been explained to those concerned. If symptoms of the disease occur after delivery in a nursing woman the infant must be weaned at once.

There are two kinds of curative treatment, the operative and the medicinal. In the latter a large number of drugs have been used, but it is safe to say that excepting phosphorus none of them holds out strong probability of benefit, and even that often fails. Lime, which might at first thought be considered a rational remedy, has given very uncertain results in practice. After all, the disease consists not in a want of lime, but in something that causes the dissociation of lime from the other bone-tissues. Some recent observers have claimed good results from calcium phosphate, in which, however, the phosphoric acid may be supposed to play the most important part. Another vaunted remedy is chloral hydrate, recommended by Petrone of Naples on the ground that chloral (or the chloroform used in operations) has a specific action on the micro-organisms that, according to him, cause the disease. Having carried out this treatment faithfully I have arrived at the same conclusion as Fehling, that the pretended remedy is of no value whatever, while the theory itself is altogether devoid of proof.

Phosphorus has often been used in the treatment of osteomalacia; frequently without benefit. According to Sternberg of Vienna, failure is due to insufficient dosage; and both he and Hartmann have reported cases in which cures could confidently be claimed. Sternberg gives phosphorus in cod-liver oil in the proportion of 0.15 to 150. (gr. iiss to f℥v); of this one teaspoonful is taken once daily. The phosphorus can also be given in the form of pills, containing one milligram (gr. $\frac{1}{60}$) each. One of Sternberg's patients took 2.25 grams (gr. xxxiv) of phosphorus in the course of the treatment, without symptoms of intoxication. The treatment must be continued for weeks or even months. The pain usually does not lessen before the end of three or four weeks. Recovery can only be asserted when the patient has recovered the use of the limbs and can carry on ordinary occupations without pain in the pelvis, legs, etc., and when tenderness on pressure and yielding of the bones no longer exist.

The operative treatment of osteomalacia is due remotely to an observation of Porro, who in 1878 reported a case of that disease which recovered after undergoing the operation named after him. Fochier suggested that such recovery from puerperal osteomalacia is due to sterilization, and Levy expressed this more strongly. It was Fehling, however, who showed by cases of his own and others not only that the Porro operation was followed by recovery, but also that removal of the ovaries was quite as efficient and of course applicable to a larger proportion of cases. Fehling and some others hold that osteomalacia is a trophoneurosis of the bones, due to ovarian irritation, and as proof of this they point to a number of cases in which the ovaries and adnexa

removed showed evidence of disease. Others have failed to find such changes in the ovaries, even when the castration was followed by unmistakable signs of improvement. Späth long ago reported a case of osteomalacia that recovered after removal of the pregnant uterus alone. This, however, does not seem to affect the question, and at present we must admit that removal of the ovaries occupies an important place in the therapeutics of osteomalacia. The indications for the operation have been formulated as follows by Winckel,[1] whose labors in this field have been so important :

1. Castration is positively indicated when all other methods of treatment have failed and softening of the bones has advanced so far that life is thereby endangered.

2. The operation is also imperatively indicated when the disease has advanced so far that death is likely to occur before medicinal treatment can have effect.

3. The operation is indicated in women whose pelves are so narrow that pregnancy would necessitate Cesarean section [castration being the safer operation].

4. Castration is indicated in case of Cesarean section in osteomalacia.

The operation is contraindicated when the bones are very soft, so that recovery cannot be hoped for, and also in cases complicated by tuberculosis.

The details of the operation belong to the domain of operative gynecology.

Of forty-one cases collected by Winckel, death occurred in five—from sepsis, cardiac weakness, or bronchitis. This mortality is greater than that of castration in general by about 10 per cent.

Treatment is necessary in all stages of osteomalacia for various symptoms common to all chronic diseases, and, in many cases, being the only thing possible, may be termed palliative. Only the more characteristic features need to be mentioned here, the other symptoms, such as bronchitis, fever, etc., being treated as under other circumstances. The patient should occupy a dry, well-aired, and in winter a well-warmed, room. The bed should be firm and smooth. In moving the patient, great care must be taken to avoid fractures, and the patient should be guarded against sudden spontaneous movements. If fracture occurs, the affected part should be protected by sand-bags, splints, or other devices. The skin must be kept in good condition by bathing, friction, change of position, etc. Bed-sores may occur in protracted cases in spite of the greatest care; they are to be treated according to the usual methods.

Care must be taken in regard to the function of the bowels and the bladder. The patient must learn to use the bed-pan and urinal. Constipation, if not overcome by the cod-liver oil, must be relieved by mild cathartics like cascara sagrada or by enemata. Pain in the muscles and cramps should be treated by warm applications and massage, or by applications of liniments of chloroform, belladonna, etc. For the rheumatic pains Winckel and others claim good results from wine of colchicum-seeds (from 30 to 40 drops) in cod-liver oil. Hot applications or fomentations may be useful for the pain of the later stages, which is often widespread, but this usually yields only to analgesics like morphin or codein.

[1] *Handbuch der speciellen Therapie innerer Krankheiten*, Bd. v. Abth. vii., Jena, 1894.

# OBESITY.

By FREDERICK P. HENRY.

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THE treatment of obesity cannot be properly discussed without some preliminary remarks concerning its nature and causes.

The state of obesity, although universally recognized, is difficult of definition, because it is impossible to draw a strict line of demarcation between it and a normal *embonpoint.* The amount of fat normally present in a healthy individual has been estimated at about one-twentieth of the weight of the body, but such a diagnostic criterion is manifestly useless. A more certain means of recognizing the minor degrees of obesity (for it is in these alone that there is any room for difference of opinion) is to be found in tables showing the relation between the height and weight of individuals of average health and strength. The following table is taken from the celebrated treatise of W. Banting, and corresponds very closely with that given by Dr. J. Adams Allen in his work on *Medical Examinations for Life-insurance:*

| Height. | Weight. |
|---|---|
| 5 feet 1 inch | 120 lbs. |
| 5 " 2 inches | 126 " |
| 5 " 3 " | 133 " |
| 5 " 4 " | 136 " |
| 5 " 5 " | 142 " |
| 5 " 6 " | 145 " |
| 5 " 7 " | 148 " |
| 5 " 8 " | 155 " |
| 5 " 9 " | 162 " |
| 5 " 10 " | 169 " |
| 5 " 11 " | 174 " |
| 6 " | 178 " |

The relation between height and weight is thus formulated by Brinton: "As a rule, it may be laid down that an adult male, in good health, 66 inches in stature, ought to weigh rather more that ten stone, or 140 pounds avoirdupois. And for every inch above and below this height, we may respectively add and subtract about five pounds."

Tables such as the foregoing, like all standards, are more or less arbitrary, as it is well known that individuals of the same height may differ materially in weight without such difference being attributable to varying amounts of fat. As a rule, however, it is the fat that turns the scale, and experience derived from life-insurance has determined that a variation of 20 per cent., or

one-fifth, from the figures given is about the maximum within the limits of health. Each case must, however, be separately studied, and it may be set down as a rule that, apart from esthetic considerations, obesity can scarcely be regarded as a morbid condition until it interferes with the avocations or general well-being of the individual.

**Origin of Fat.**—Fat is contained in a special tissue—the so-called adipose tissue—composed of cells containing in their walls a vesicular nucleus in the interior of which may be one or more nucleoli. The cavity of the cell is filled in part with fat, in part with finely granular protoplasm. Each one of these cells is complete, so far as the function of storing fat is concerned—a fact that has caused the adipose tissue to be described as an agglomeration of unicellular glands. The relations of the adipose tissue to the circulation are most intimate, each of the cells of which it is composed being surrounded by a vascular network. This arrangement favors in the highest degree the rapid storage of fat or its equally rapid combustion, in accordance with the general state of nutrition.

We have now to consider the manner in which the fat is conveyed to the adipose tissue. It is universally admitted that the fat of our bodies may be derived either directly or indirectly from the three principal classes into which alimentary substances are divided—namely, the fats, the albumins, and the carbohydrates. In the small intestine, under the combined action of the bile and pancreatic juice, the fats are partly emulsified, partly dissolved, and partly converted into glycerin and fatty acids. The glycerin combines with nascent phosphoric acid generated by the action of the hydrochloric acid of the gastric juice upon the phosphates of the food, and is absorbed as phospho-glyceric acid. The fatty acids unite with alkaline bases and form soaps that are readily absorbed. Both the fatty acids and the glycerin readily undergo combustion and contribute, with the carbohydrates, toward the formation of heat, their final products being water and carbonic acid. There remain to be disposed of the emulsified and dissolved fats. These, being much less combustible, are separated from the blood by the subcutaneous adipose tissue, or, if they be in decided excess, are deposited also in the more deeply seated connective tissues and in the hepatic cells. Fat, as stated, is also derived from the decomposition of albuminous substances. The latter, in the course of their retrograde metamorphosis, give rise to both nitrogenous and non-nitrogenous compounds. The former consist chiefly of leucin, tyrosin, and urea; the latter, of substances analogous to those resulting from the destruction of fats and carbohydrates. The derivation of fat from albuminoids is further proved by the fatty degeneration of muscle when the blood and, consequently, the muscular tissues are insufficiently supplied with oxygen. A familiar example of this process is the fatty degeneration of the heart in cases of pernicious anemia.

It is widely taught that the part taken by the carbohydrates in the formation of fat is an indirect one, these substances, by their ready combustion, preventing the oxidation of the carbon contained in the proteid food and so permitting it to be stored up as fat. The carbohydrate itself, it is argued, "never becomes fat, but its presence allows fat to be formed out of proteid material."

The latter statement is altogether too strong, and the truth undoubtedly is that carbohydrates contribute directly as well as indirectly to the formation of fat. Their direct action in this process is proved by the fact that an animal fed with a moderate amount of proteids and a large amount of carbohydrates will accumulate much more fat than can be accounted for by the carbon contained in the proteids. The latest contribution to this subject is by Pavy,[1] who adduces numerous well-known facts proving the conversion of carbohydrates into fat. Among these is the presence of from 1 to 2 per cent. of fat in yeast that has grown in a medium containing no fat "and with sugar as the only possible source of it," in ripening seeds, in the milk of the cow, in the *foie gras* of the Strasbourg goose, etc. Pavy has also demonstrated that the intestinal villi as well as the lacteals of the mesentery and the receptaculum chyli, of a rabbit after a meal of oats, are opaque and white from their fatty contents, and this well-known authority regards the intestinal villi as the seat of the production of fat from carbohydrate matter. From the foregoing remarks it is evident that fat may be derived from albumin, fat, and carbohydrates—a fact that has a decided bearing upon the dietetic treatment of obesity.

**Etiology.**—The exciting causes of obesity are over-eating and deficient exercise, or a combination of both these factors. Apparent exceptions to this rule are numerous; in fact, it is a matter of common observation that many individuals remain lean in spite of an abundant consumption of food, while others accumulate fat on what is supposed to be a moderate diet. In explanation of such anomalies it has been maintained, on purely theoretic grounds, that, in the former, a large part of the ingested food is undigested and unabsorbed, whereas, in the latter, the processes of absorption are much more complete. This view of the case is untenable, for it has been demonstrated experimentally that from 90 to 96 per cent. of the nutritive elements of the food, irrespective of its amount, is absorbed from the intestinal tract. Even a moderate diarrhea, according to F. Hirschfeld,[2] has very little effect in preventing absorption, the only thing that hinders it, in marked degree, being the ingestion of vegetables rich in cellulose.

The popular estimate of an abundant diet is erroneous, inasmuch as it is generally based upon the quantity of albuminous food ingested. An individual who consumes daily a large quantity of meat—for example, as much as is contained in two beef-steaks—is supposed to be a much larger eater than one who lives upon bread, butter, and milk. The following tables taken from Hirschfeld show that this opinion is erroneous. In the first is estimated the nutritive value of a diet largely composed of meat; in the second, that of a diet of bread, butter, and milk:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 400 | grams | meat | = | 84 | grams | albumin, | 8 | grams | fat. | | |
| 40 | " | butter | = | | | | 35 | " | " | | |
| 300 | " | potatoes | = | 6 | " | " | | | | 60 | grams carbohydrates. |
| 50 | " | bread | = | 4 | " | " | | | | 30 | " " |
| | | | | 94 | " | " | 43 | " | " | 90 | " " |

[1] *Physiology of the Carbohydrates*, 1894. [2] *Zeitschrift für klinische Medicin*, No. 22, 1893.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 250 grams bread | = | 20 | grams | albumin, | | | | 150 | grams | carbohydrates. |
| 60 " butter | = | | | | 50 | grams | fat, | | | |
| 500 c. cm. milk | = | 18 | " | " | 15 | " | " | 20 | " | " |
| | | 38 | " | " | 65 | " | " | 170 | " | " |

If the nutritive value of these two diet-lists be reckoned in accordance with the number of calories furnished by their consumption in the organism, it will be found that the second is decidedly superior to the first. For example,

| | | | |
|---|---|---|---|
| 1 gram | albumin | produces | 4.1 calories |
| 1 " | fat | " | 9.3 " |
| 1 " | carbohydrate | " | 4.1 " |

The first diet-list is, therefore, equivalent to 1150 calories, and the second to 1450 calories. These tables demonstrate how utterly false is an unscientific estimate of the nutritive value of a particular diet. A fat person consuming the substances enumerated in the second diet-list would be popularly supposed to be living on a rather spare diet, while a lean person devouring the meat of the first list would be regarded by many as a gourmand.

A healthy man at rest requires, to maintain his nutritive equilibrium, an amount of food equal to from 34 to 40 calories per kilogram of body-weight. For such an individual, weighing 60 kilos (150 lbs.), there would be needed 80 grams of albumin, 80 grams of fat, and 320 grams of carbohydrates, which by their combustion in the organism are equivalent to 2400 calories, *i. e.* 40 calories per kilo. A much smaller quantity than this, relatively, is required by the corpulent. Hirschfeld compared the amounts of food required by two women of the same height, the one, however, weighing 50 kilos, the other 100 kilos. The first consumed, while at rest, 70 grams of albumin, 60 grams of fat, and 280 grams of carbohydrates—*i. e.* 2000 calories, or 40 calories per kilo—and while engaged in active exercise could consume food equivalent to 2500 calories without adding to her weight. The latter quantity could not be consumed by the second woman without increasing her weight, and this evidently because it was physically impossible for her to take as much exercise as No. 1 ; while the first-mentioned amount of food sufficed to maintain a weight double that of No. 1. Such facts as these apparently support the popular belief that fat persons eat less than the lean, for it is undoubtedly true that their weight may be maintained by a diet that would be insufficient for a lean person *engaged in active exercise.*

It is far easier to form a correct estimate of the second factor in the production of obesity—deficient exercise. With reference to this point, important data are furnished by the nature of the patient's occupation. The professional and mercantile classes habitually take an insufficient amount of exercise—a fact so notorious that their occupations are significantly classed as sedentary. On the other hand, a street-laborer is engaged in severe bodily exercise from morning till night. Obesity is common in the first-mentioned class and practically unknown in the second.

*Heredity.*—According to the statistics of Chambers and Bouchard an hered-

itary predisposition to obesity may be traced in one-half of the cases. It may be manifested either directly or collaterally, or it may skip a generation. Hereditary obesity is distinguished by its precocity, generally developing between infancy and puberty. Numerous instances of congenital obesity are on record. For example, Chambers reports the case of a child that, at birth, weighed 16 pounds; at one year, 40 pounds, and shortly before its death from bronchitis at three years, 87 pounds. Such cases, however, are not more frequent in obese families than in others.

Certain French writers, following Bouchard, maintain that the hereditary tendency to obesity is transmitted indirectly through the medium of an arthritic diathesis. The author just mentioned found, among the progenitors of 94 cases of obesity, 33 cases of rheumatism, 28 of gout, 24 of asthma, and numerous other instances of affections included under the head of arthritism. Bouchard defines "arthritism" as a disorder of nutrition that consists in a sluggish performance of the intracellular exchanges of matter—in short, as a "bradytrophic diathesis." Without pausing to inquire whether such affections as migraine, eczema, lithiasis, dyspepsia, and hemorrhoids are invariably of "arthritic" origin, we may accept, without reserve, the statement that the nutritive exchanges are frequently less than normally active in the obese and in those predisposed to obesity.

*Sex.*—The influence of sex in the production of obesity is decided. Of 111 cases observed by Bouchard 75 were in females. This preponderance on the part of females is not solely to be attributed to their comparatively sedentary existence, but is largely due to circumstances connected with the performance of their uterine functions. In many cases the beginning of obesity dates from the first parturition; in many others it is associated with menorrhagia or metrorrhagia. In the two last-mentioned conditions, as well as in chlorosis, the accumulation of fat is dependent upon deficient oxidation, this, in its turn, being due to reduction in the amount of hemoglobin, the chief oxygen-carrier of the body. Cases such as these are to be included among the "anemic fat."

**The Blood in Obesity.**—The last remarks lead naturally to the consideration of the state of the blood in the obese. A general division of corpulency into anemic and plethoric forms is universally made, but is, as a rule, based upon very imperfect observation. Anemia is recognized (?) chiefly by pallor of skin and visible mucous membranes; plethora, by a florid appearance of the same parts. It is scarcely necessary to add that all who have occupied themselves with the clinical examination of the blood are aware of the fallacious nature of such signs. Until quite lately, however, little attempt at greater diagnostic accuracy in this direction had been made. It is true that Leichtenstern in his pioneer work[1] gives the hemoglobin-percentage of four corpulent individuals, and although it is decidedly below the normal he justly regards the number of cases as too small to warrant any general conclusions. So far as I am aware, the most valuable contribution to our knowledge of this subject

[1] *Untersuchungen über den Haemoglobingehalt des Blutes in gesunden und kranken Zuständen*, Leipzig, 1878.

was made in 1887 by E. H. Kisch,[1] who determined the hemoglobin-percentage in 100 cases of obesity, 59 of which were in men and 41 in women. In 79 of the cases (52 males, 27 females) the percentage of hemoglobin was increased; in 21 cases (7 males, 14 females) it was diminished. Taking the sexes separately, Kisch found that of the 59 men there was an increase of hemoglobin in 52 (88 per cent.) and a diminution in 7 (12 per cent.); whereas, of the 41 women the hemoglobin was increased in 27 (66 per cent.) and diminished in 14 (34 per cent.). If, therefore, we accept Traube's division of corpulency into plethoric and anemic forms, it is evident that, in Kisch's statistics, the proportion of the former to the latter was, in men, as 7 : 1; in women, only as 2 : 1.

In such observations as those just cited there is a possible source of fallacy dependent upon the fact that it is impossible to estimate the quantity of the circulating blood. The statement may be made, and it cannot be disproved, that the so-called plethoric fat are in reality anemic, because the mass of blood in their huge bodies is not relatively increased. It will, however, be admitted by all who have any practical knowledge of the subject that the hemoglobin-test is the best that we possess of the quality of the blood, and that, excepting cases in which the latter is manifestly inspissated, as in cholera and in stricture of the esophagus (conditions in which the output of water is excessive or its income greatly diminished) an increase of hemoglobin above the normal, coinciding with a normal or increased number of red corpuscles, is significant of plethora.

**Treatment.**—The foregoing remarks concerning the nature and etiology of obesity indicate the methods of a rational treatment of the condition. It being abundantly demonstrated that fat may be derived from any of the staple articles of food (fats, carbohydrates, proteids), it is manifest that the dietetic treatment of obesity is largely one of restriction. It is not so much the quality of the food as its quantity that is to be regulated. An obese person may contend that his diet is already a scanty one; nevertheless it is manifest that so long as he is increasing in weight he is consuming too much food. A review of the principal diet-lists of well-known authorities will amply verify this statement. They are all decidedly slender and all more or less successful. The latter fact is of great practical interest inasmuch as it enables the physician to vary the monotony of the treatment by placing the patient first on one dietetic system and then on another. There are, however, certain objectionable features in several of these methods of treatment, to which attention will be directed.

The oldest regimen for the reduction of obesity of which we have any record is that contained in the works of Hippocrates, and it is an interesting fact that, in so far as it permits an abundance of fatty food, it is identical with the diet prescribed for the same purpose by Ebstein. It is only in quite recent times, however, that the dietetic treatment of obesity has been reduced to any-

[1] "Ueber den Haemoglobingehalt des Blutes bei Lipomatosis universalis," *Zeitschrift für klinische Medicin*, Bd. xii., 1887.

thing like a system, and there can be no doubt that the greatest impetus in this direction has been given by the popular treatise of Mr. Banting. Before Banting, however, a French military surgeon, Dancel, had studied the subject of obesity from a clinical standpoint and had formulated a dietetic system which is undoubtedly effective. Its principal feature is the exclusion of water, and is based upon the fact that he succeeded in fattening a cavalry-horse by reducing its daily supply of oats to the extent of 1½ kilograms and at the same time giving the animal more than its customary supply of water. In the course of twenty-seven days the horse gained 18 kilos. On the other hand he reduced the weight of a mare that was enormously fat, and greatly improved its general physical condition, by curtailing its supply of water from 60 liters to 15 liters.[1] Abstinence from liquids is not the sole feature of Dancel's method.[2] He also restricted the amount of the fatty and farinaceous articles of food, and recommended the frequent use of purgative drugs and a large amount of pedestrian exercise. Dancel's directions are not sufficiently precise, although it is undeniable that obesity may, in many cases, be held in check, or diminished, by their observance. They are referred to chiefly on account of their historic interest.

"*Bantingism.*"—In 1863 Mr. William Banting of London, in his celebrated "letter on corpulence addressed to the public," gave the details of a dietetic system by means of which his weight was diminished in thirty-eight weeks 37 pounds, and his girth several inches. At the beginning of the treatment Banting was nearly sixty-six years of age, and weighed 202 pounds. As his height was 5 feet 5 inches he should have weighed, according to the table on a previous page, 142 pounds. He suffered greatly from what he terms the "parasite" obesity; was compelled to go down stairs "slowly backward, to save the jar of increased weight upon the ankle-joints and knee-joints," and had been obliged to "puff and blow with every slight exertion, particularly that of going up stairs." All these, and other symptoms to which he refers, disappeared in the course of nine months under the following regimen:

For breakfast: Four or five ounces of beef, mutton, kidneys, broiled fish, bacon, or cold meat of any kind, except pork; a large cup of tea (without milk or sugar), a little biscuit, or one ounce of dry toast.

For dinner: Five or six ounces of any fish except salmon, any meat except pork, any vegetable except potato, one ounce of dry toast, fruit out of a pudding, any kind of poultry or game, and two or three glasses of good claret, sherry, or Madeira. (Champagne, port, and beer forbidden.)

For tea: Two or three ounces of fruit, a rusk or two, and a cup of tea without milk or sugar.

For supper: Three or four ounces of meat or fish, similar to dinner, with a glass or two of claret.

[1] *Bulletin général de Thérapeutique*, 1864, tome lxvii. p. 44.

[2] The term abstinence, as here employed, is a relative one. Dancel permitted from six to twelve ounces of water at each meal—an amount that seems to me at least as large as is consumed by the average healthy individual.

For a "nightcap," if required: A tumbler of grog (gin, whisky, or brandy, without sugar) or a glass or two of claret or sherry.

On this plan, Banting says, besides steadily decreasing in weight, he had "excellent nights' rest with from six to eight hours' sound sleep." His previous dietary had been "bread and milk for breakfast or a pint of tea with plenty of milk and sugar, and buttered toast, meat, beer, much bread (of which I was always very fond), and pastry for dinner, the meal of tea similar to that of breakfast, and generally a fruit tart or bread and milk for supper." "I had," says he, "little comfort and far less sound sleep." He makes no allusion to the amount of alcohol consumed, either with meals or in the form of the so-called "nightcap," previous to the institution of treatment. The chief feature of the Banting system is the exclusion, to a very great extent, of starch, sugar, and fat, and the permission of an unusual amount of alcoholic beverages. The fluids were not greatly reduced; they amount, exclusive of the "nightcap," to thirty ounces *per diem*—a quantity no less than is consumed by many healthy individuals. The success of Banting's method in his own case was certainly brilliant, but it is equally certain that it is far from universally applicable. It is to be regretted that there is no record of an examination of Banting's urine, but even in its absence it is safe to assume that he was neither lithemic nor gouty; otherwise he could not, in my opinion, have maintained his health upon a dietary so largely composed of proteids and alcohol.

Ebstein's dietary differs radically from that of Banting in that it permits an abundance of fat. This well-known authority states that, in his opinion, "it has yet to be proved that any portion is deposited of the fats which are taken with our food into the body, so far as it is in a healthy and normal condition. . . . On the other hand, it is certain that *fat becomes separated from albumin*, three and a half ounces of which yield, according to Henneberg, rather less than two ounces of fat." Ebstein also holds that fat is not directly formed from carbohydrates, but that the latter by their ready combustion in the organism "protect a portion of the decomposed albumin from total decomposition, and what thus survives is the fat so rich in carbon."[1] In consequence of this view as to the nutritive function of the carbohydrates, he permits more than double the amount of these substances contained in the dietary of Banting. On the other hand, the albuminous materials are decidedly less. No kind of meat is excluded; the patient is encouraged to eat freely of butter and all kinds of fat, and, when no other kind of fat is at hand, marrow is to be added to the soup. There is no doubt that, as Ebstein claims, the abundant ingestion of fat diminishes the craving both for food and drink, and that the permission of such articles as salmon and *pâté de foie gras* "reconciles the corpulent gourmet to his other sacrifices."

The following diet was observed by a patient of Ebstein, who, in the course of nine months, lost about six inches of his girth, the diminution in weight and size being coincident with decided improvement in the bodily and mental faculties and in the general health.

[1] Ebstein: *Corpulence and its Treatment*, London, 1884.

"1. *Breakfast.*—One large cup of black tea—about half a pint—without milk or sugar; two ounces of white or brown bread toasted, with plenty of butter. (In winter about half-past seven, in summer about six or half-past six.)

2. *Dinner* (between 2 and 2.30 P. M.).—Soup, often with marrow; from 4 to 6½ ounces of roast or boiled meat, vegetables in moderation, leguminous preferably, but also cabbages. Owing to their saccharine ingredients turnips were almost, and potatoes altogether, excluded. After dinner a little fresh fruit when obtainable. For a second course a salad or occasionally some stewed fruit without sugar. *Beverage:* Two or three glasses of light white wine. Immediately after dinner, a large cup of black tea without sugar or milk.

3. *Supper* (from 7.30 to 8 P. M.).—In winter almost invariably, in summer occasionally, a large cup of black tea without milk or sugar. An egg or a little fat roast meat, or both, or some ham with its fat; Bologna sausage, smoked or fresh fish, about one ounce of white bread well buttered, occasionally a small quantity of cheese, and some fresh fruit."

Sugar, sweets of all kinds, and potatoes are forbidden unconditionally by Ebstein.

The chief objection to Ebstein's dietary is the fact that it is liable to lead to a mild form of gastric catarrh in cases in which the motor function of the stomach is impaired, as this is likely to be in cases of obesity. "Fat is reduced to oil at the temperature of the body, and, as it frees itself, floats on the surface of the stomach-contents, where it does no harm if digestion is accomplished and the stomach emptied in the normal time. But where retention of food occurs, as in atony of the stomach, its presence favors the growth of organisms which convert it into butyric acid, a substance which is especially irritating to the gastric mucous membrane."[1] In fact, Hirschfeld[2] contends that the satiety produced by the ingestion of fat, which Ebstein regards as an advantage, is in reality due to dyspepsia.

Oertel's dietary differs from those of Banting and Ebstein in containing more fat than that of the former, and about double the quantity of albuminates and carbohydrates and half the amount of fat in that of the latter.

The following is a sample of the daily bill of fare:

"*Morning Meal.*—Coffee 4¼ ounces, milk 1 ounce, sugar 77 grains, wheaten bread 1¼ ounces.

"*Mid-day Meal.*—Soup 3 ounces; roast or boiled beef, or veal, or game, or lean poultry, 7 to 8 ounces; fresh salad 1 ounce, bread 1 ounce, never to exceed 3 ounces; fruit 3 to 6 ounces; a little fish if desired. Light wine, 6 to 8 ounces, if no fruit, or if very hot weather, otherwise no fluid with this meal.

"*Afternoon Meal.*—Coffee 3½ ounces, milk 1 ounce, sugar 77 grains, water 2 ounces, never more than 6 ounces; bread 1 ounce (exceptionally).

"*Evening Meal.*—Wine 7 ounces, water 2 ounces, one or two eggs, roast meat 5 ounces, salad 1 ounce."[3]

[1] Saundby: *The Ingleby Lectures*, 1894. [2] *Loc. cit.*

[3] Whitla's *Dictionary of Treatment*, 1892.

The quantity of water in Oertel's dietary is restricted to about one quart daily, including that contained in the solid ingesta. About one pint of *free* water is permitted.

The foregoing are three of the principal dietetic methods of treating obesity. There are numerous others, such as those of Vogel, Dujardin-Beaumetz, Yeo, etc., but they all agree in that the quantity of food which they contain is decidedly below the daily average of a healthy man. The methods are, therefore, to a certain extent those of starvation, the patient, while they continue, being compelled to consume the excess of fat in his body. This is manifest from the following table compiled by Dujardin-Beaumetz:

| | Proteids. | Fats. | Carbohydrates. |
|---|---|---|---|
| Harvey's dietary . . . . . | 170 grams. | 10 grams. | 80 grams. |
| Ebstein's " . . . . . | 100 " | 85 " | 50 " |
| Oertel's " . . . . . | 155–179 " | 25–40 " | 70–100 " |
| Ration of a healthy man . . . . | 124 " | 55 " | 433 " |

I am strongly of the opinion that each case of obesity should be studied separately and treated on its own merits. I cannot, therefore, recommend any dietetic system as universally applicable to the treatment of the condition. For example, it is manifest that the treatment of an obese plethoric individual should be different from that of one who is anemic. The question of the state of the blood should, therefore, be settled by proper examination before instituting treatment. Valuable indications may also be derived from an examination of the urine. The presence or absence of the gouty or lithemic diathesis is thus determined and the diet regulated accordingly. The researches of Albert Robin render it also probable that a study of the urine will throw light upon the question whether or not the quantity of water is to be restricted in the treatment of an individual case of obesity.

*The Use of Water in the Treatment of Obesity.*—The opinions concerning the effect of water in the production and maintenance of obesity are widely variable, some believing with Dancel that it tends to increase the formation of fat; others that it has no effect whatever in this direction; while still others hold that it reduces the amount of adipose tissue. Debove[1] endeavored to settle this disputed question by the following experiment: The subject, an hysterical, hypnotizable woman, was first placed upon a diet that maintained her weight and her excretion of urea at a uniform figure. The amount of fluid ingesta was then quadrupled (instead of a liter of "tisane" she was made to drink four liters), no alteration being made in the quantity or quality of the solid food. This period of excessive ingestion of water continued one month. At the end of this time the amount of liquid was again reduced to one liter as at first. From the beginning to the end of this experiment there was no material alteration in the patient's weight, and Debove, therefore, concludes that water has no effect whatever upon the weight of the body or upon the excretion of urea. Debove's communication was criticized by Hayem and

[1] *Bull. et Mém. de la Soc. méd. des Hôpitaux de Paris*, 3e série, 1885.

Guyot on the ground that his patient was hysterical, and therefore, not in a physiologic condition, whereas Debove maintained that the usual sources of error in such observations were eliminated by the fact that the patient carried out the orders of her physician and attendants under hypnotic suggestion, the mechanical precision of hypnotic obedience being its chief characteristic. Apart from any question of its intrinsic value the experiment is certainly one of great interest from a dietetic standpoint, and it has had the beneficial effect of stimulating others to similar investigations.

Robin,[1] whose researches have already been alluded to, endeavored to ascertain the effect of an abundant ingestion of water upon the excretion of urea, and confirmed the conclusion of Genth that it increases the amount of urea and salts in the urine. He next decided by a process of deduction that this increase of solids in the urine is not the result of a lavage of the tissues, *i. e.* of a washing out of already formed urea, but that it is the result of increased oxidation. Applying these facts to the treatment of obesity, he divides the corpulent into two classes: (1) Those in whom assimilation is increased; (2) those in whom disassimilation is diminished—or, to use his own words, the corpulent from excess (*par excès*) and the corpulent from defect (*par défaut*). The first are recognized by the fact that their excretion of urea is increased; the second by the fact that it is diminished. There is apparently a third class, in which the quantity of urea does not deviate from the normal, but those belonging thereto may readily be placed in one or other of the categories mentioned by determining their "coefficient of oxidation," *i. e.* the relation between the urea and the other solids in their urine. If this coefficient is augmented, they are obese by excess; if diminished, they are obese by defect.

The practical outcome of these investigations is that a minimum quantity of water should be permitted to the obese *by excess* while it may be allowed *ad libitum* to the obese *by defect*. Robin has tested the correctness of his conclusions in three cases of which I have knowledge. In the first two, the "coefficient of oxidation" was subnormal and the patients were allowed to drink freely of water; in the third, the coefficient of oxidation was normal and the water was reduced to a minimum. In all three the weight was rapidly reduced. It is scarcely necessary to add that in each case the solid elements of the dietary were practically identical, both as to quantity and quality.

Cases treated in accordance with Robin's rule have not yet accumulated in sufficient number to thoroughly attest its correctness. The discrepant opinions held by the most competent observers concerning the use of water in obesity practically demonstrate that it is beneficial in some cases and injurious in others, and it seems probable that in Robin's test we have a guide to a correct decision regarding its use.

*Exercise* is all-important in the treatment of obesity, and is far too little insisted on by certain writers upon the subject. It is an interesting fact that fat does not accumulate to any great extent in muscles that are exercised; or

[1] *Bull. et Mém. de la Soc. méd. des Hôpitaux de Paris*, 1886, tome iii. p. 21.

perhaps it is more correct to say that if the muscles of the body are uniformly exercised the fat is more uniformly distributed. Obesity would not be so disfiguring and consequently so much dreaded by those who have a natural regard for their personal appearance if the fatty accumulation were evenly distributed. Unfortunately, from an esthetic point of view, there is a marked tendency to the deposit of fat in certain regions of the body and especially over the abdominal muscles. This statement is solely applicable to man. The enormous paunch which is so disfiguring to the human being is never seen in the lower animals, not even in the hog, which may be taken as the type of obesity. The reason of this difference is, I believe, to be found in the fact that the abdominal muscles of quadrupeds are constantly exercised in locomotion, whereas in the human subject they are rarely severely taxed except during the acts of defecation and parturition. That these muscles are capable of great development in man is shown by their size and distinctness in professional athletes and in street-laborers who wield the spade and stone-pounder; whereas in the average man, even though not corpulent, scarcely a trace of them can be seen.

In prescribing exercise to the corpulent, the previous habits of the patient and the state of the heart must be taken into careful consideration. One who has been accustomed to athletic exercises in his ante-corpulent days can resume them with comparative ease, while he who has always been slothful should begin with the gentlest movements and very gradually undertake the heavier gymnastics. The muscles that should be specially exercised are those of the abdominal wall, and for this purpose there is nothing better than lying on the back and gradually rising to a sitting posture; or the same result may be accomplished by retaining the dorsal decubitus and raising the extended lower extremities to a right angle with the trunk. By such simple maneuvers, in addition to a regulation of the diet, I have known the girth to be reduced about three inches in as many months. The abdominal muscles, together with those of the arms and legs, may also be exercised by special apparatus such as rowing-machines, health-lifts, etc., but no elaborate apparatus is necessary. Any intelligent physician can instruct his patient how to exercise his abdominal muscles indoors by various movements which call them into play. In the way of outdoor exercises there are none better than walking, rowing, and riding. It is too much the custom for middle-aged men in the United States to give up the active exercises of their youth; in consequence of which they become not only obese but prematurely stiff in the joints and arteries. It is a popular saying that no one over forty should run after an omnibus or a street-car, but should wait patiently for the next one. It is certainly true that numerous sudden deaths have followed such exploits, but they were chiefly due to the fact that the unfortunate individuals had taken no active exercise for years prior to the fatal spurt.

Various drugs have been recommended for the treatment of obesity, but it is probable that their beneficial (?) effects are due to the gastric irritation and consequent loss of appetite that they induce. Chambers employed, with apparent success, liquor potassæ, giving it in milk in doses of from half a dram to one dram

(2.–4.) thrice daily. In his treatise on corpulence he refers to several cases in which decided benefit was derived from this remedy. Vegetable acids, especially acetic acid, the bromids, potassium iodid and permanganate, sodium chlorid, and fucus vesiculosus are the chief remaining drugs that have been used to reduce fat, but they are probably all inert. The last-mentioned drug, fucus vesiculosus, has probably been the most widely employed for this purpose. It is the ordinary bladder seaweed, and, according to Whitla, is used in the north of Ireland for the purpose of *fattening* pigs. Comment is unnecessary.

Of late years obesity has been successfully treated with thyroid extract. Leichtenstern[1] has thus treated 27 cases, with positive results in 24, the loss of weight varying from 1 to 5 kilos (2.2–11 lbs.) in the first week, and from 1.5 to 9.5 kilos (3.3–21 lbs.) in the course of several weeks. Wendelstadt[2] has had similar success—25 cases, with positive results in 22. C. A. Ewald[3] reports a case in which, under treatment with thyroid extract, there was a loss of 9.2 kilos (20.2 lbs.) in six and a half weeks. The cases in which the remedy was most successful were the anemic, flabby fat with edematous-looking faces—cases that bear a superficial resemblance to myxedema. I described this condition of "myxedematoid dystrophy" in 1891,[4] and Dercum[5] has since reported cases that belong in the same category.

The use of thyroid extract does not remove the necessity of a careful regulation of the diet and the mode of life. The unpleasant and sometimes alarming symptoms included under the term "thyroidismus" may be avoided, as a rule, by careful dosing.

Turkish baths, unless so frequently repeated as to injure the health, are of little or no benefit in the treatment of obesity. They will reduce weight rapidly, but loss of weight is not synonymous with loss of fat. Any measure that excites free perspiration will reduce weight, but such loss of weight is chiefly due to loss of water, and is regained as rapidly, by the ingestion of fluid, as it was lost.

In conclusion I would reiterate the opinion that the only rational treatment of obesity is a combination of diet and exercise judiciously adapted to each case of the disease, and that the only medicament from which benefit may be safely derived is thyroid extract. The age, the sex, the previous habits of the patient, and the state of the heart and arteries and of the blood and urine, should be carefully considered, and the result of such study will modify more or less the treatment of each obese patient. It is manifestly impossible to formulate a system of diet and exercise adapted to every case of the affection, and therefore, in the foregoing remarks, I have merely endeavored to indicate the general principles on which the treatment of individual cases of obesity should be conducted.

[1] *Deutsche medicinische Wochenschrift*, 1894, No. 50.
[2] *Ibid.*
[3] *Berliner klinische Wochenschrift*, 1895, No. 3.
[4] *Journal of Nervous and Mental Diseases*, March, 1891.
[5] *American Journal of the Medical Sciences*, Nov., 1892.

# DIABETES.

By JAMES STEWART.

## Diabetes Mellitus.

The intimate nature of the changes that induce diabetes mellitus are unknown. Several views are at present held as to the nature of these processes, but much has to be added to our knowledge before any one of these can be accepted as fully explaining the nature of the disease. According to Claude Bernard the blood in health contains a certain quantity of sugar which undergoes destruction in the process of nutrition and leaves the body in the form of carbon dioxid and water. The blood-sugar is supplied by the liver, which has the power, it is alleged, of converting the glucose brought to it through the portal system into glycogen and reconverting this into sugar as the needs of the economy demand. The liver is looked upon as a regulator of the sugar-forming process, and anything that will interfere with this function or with the nutritive changes concerned in the destruction of sugar will give rise to diabetes. Seegen maintains that, in addition, the liver has another function, viz. the formation of sugar out of the albuminates and fats, and that interference with this function will also give rise to diabetes. He claims that the disease is brought about quite independently of the glycogenic function of the liver, and he looks upon it as a more general disturbance of nutrition. He divides diabetes into two forms, the severe and the mild, the former being induced by derangement of the general nutritional state, which interferes with the destruction of sugar in the circulation; the latter being due to disturbance of the glycogenic function of the liver. The severe cases are characterized by a rapid and fatal course; the mild ones, on the other hand, run a very chronic course and do not, as a rule, directly shorten life materially.

Seegen draws the further distinction, between these two forms of diabetes, that the mild cases, when put on an exclusively non-carbohydrate diet, quickly improve, the sugar disappearing from the urine and the other symptoms also subsiding. In the severe cases, the sugar, although diminishing, does not disappear from the urine when an exclusively non-carbohydrate diet is strictly adhered to.

For many years Pavy[1] has energetically combated the views put forth by Bernard on the formation and destruction of sugar by the liver, and has recently announced the results of a series of painstaking and laborious researches on this subject extending over many years. He maintains that

[1] *British Medical Journal*, vol. ii., 1894, p. 85.

"The liver is not the source of sugar, but instead of throwing sugar into the circulation it checks the progress of sugar by abstracting it from the portal blood. If the liver does not perform this office the result is diabetes, and if sugar really originated in the liver we ought all to be diabetic. Glycogen is a store of carbohydrate in the liver, but it is not subsequently reconverted into sugar, to be transmitted onward once more. The liver, if removed fresh from the body, yields no more sugar than any other organ; the venous blood is not poorer in sugar than is arterial blood, as it should be if sugar left the circulation at the systemic capillaries as is implied in the ordinary glycogenic doctrine, and the portal blood during feeding is always richest in sugar. What, then, is the fate of the hepatic glycogen if it does not lead to the formation of sugar? The answer given to this is that it is applied to the construction of proteid, of fat, or of both. The power of the animal body to form fat from carbohydrates is certainly undoubted. . . . In the formation of fat from carbohydrates the proteids are regarded as intermediaries. The carbon goes in as carbohydrates and comes out as fat. The formation of fat from starch is not limited to the liver-cells, but is accomplished also by those little masses of protoplasm that cover the intestinal villi."

The application of all this to explain many of the phenomena of diabetes is obvious. Given a moderate degree of that disease, it is a known clinical fact that a diet in which the amount of carbohydrate is restricted is followed at once by a disappearance of the glycosuria. This Dr. Pavy would explain by supposing that the power of his "two lines of defence"—the living protoplasm of the villi and of the liver—to stop soluble carbohydrates and to convert them into proteids, to transmute them into fat, and to dehydrate them into amylose (glycogen)—is impaired, but not destroyed. In more severe cases there is still greater improvement, while in the worst cases of all—those in which, even with a diet from which all carbohydrates are excluded, sugar appears still in the urine—not only are the "two lines of defence" so completely broken down that even the carbohydrate which he asserts is cleansed off from albuminous food by fermentative action in the process of digestion is not synthetized into proteid. This failure is to be attributed to hyper-oxygenation of the blood due to dilatation of the arterioles, permitting the blood to pass with undue rapidity from these vessels through the systemic capillaries to the venous side. The dilatation of the arterioles is attributed to a derangement of the controlling power of the vaso-motor nervous system. In the more severe cases it is possible that something is added over and above this, and this something is probably of the nature of a ferment.

Whatever view of the nature of diabetes is adopted in the various modern hypotheses, there appears to be a general consensus of opinion in attributing the ultimate cause to some disorder or disturbance of the central nervous system. When we consider the marked hereditary tendency in certain families to the disease, the not uncommon history of nervous traumatism in severe cases, the pregnant influence of profound emotion and nervous strain in many cases, it is not surprising that all those who have closely studied the disease have to

fall back on some such disturbance. Further than this it is impossible to go at present. In dealing with the disease it is of prime importance to inquire closely into all possible exciting causes and to endeavor to remove or mitigate them.

**Dietetic Treatment.**—The dietetic treatment of diabetes is by far the most important therapeutic means at our command. In the mildest cases, by an appropriate diet we can arrest the glycosuria and other symptoms of the disease, and in severer cases greatly mitigate the chief symptoms. The basis of the dietetic treatment is the withholding of all forms of food that contain sugar or substances that can be converted into sugar in the body.

Two great practical difficulties are met in endeavoring to carry out this dietetic regimen. First, we are constantly reminded in practice that such a restricted diet seriously interferes with nutrition if carried out fully for lengthened periods, and it not infrequently happens that we are compelled for the patient's safety to allow such articles as are not otherwise advisable. This difficulty is especially marked in those subjects who are reduced in flesh and strength. Secondly, the distaste arising for such food and the often pressing hunger for carbohydrates make the treatment a matter of great difficulty, and often it is found necessary to allow for short periods food that would be otherwise forbidden.

Albuminates and fats should constitute as far as possible the diet of a diabetic. I have been in the habit for some time of carrying out a suggestion referred to by Burney Yeo, of testing occasionally the capacity of these patients to metabolize certain carbohydrates. In this way individual peculiarities will be discovered which enable us to allow certain patients small amounts of carbohydrates for longer or shorter periods. As a rule, it will be found that the greatest practical difficulty is the finding of a suitable bread or substitute for it. Bread made from gluten-flour is commonly employed. It contains more or less starch, some samples containing a great deal; and further, it is, as a rule, badly digested by many patients. Almond-flour, made into cakes with eggs, is recommended by Seegen, but it is too expensive for most people. Further, it contains more or less starch. Potato-meal is considered by many to be a better substitute for ordinary bread than either almond-bread or gluten-bread.

Bran-bread, one of the simplest of all substitutes for wheat-bread, can be used by most patients for two or three weeks at a time. It is practically devoid of starch. Another substitute of value is torrefied bread, which is made by cutting very thin slices of ordinary bread and toasting them before the fire until the surfaces are black. The starch is for the most part destroyed by the heat. A form of gluten-bread, introduced by Ebstein, is recommended as being also of value. It is called "Aleuronat." It is composed of vegetable albumin and only a small quantity of carbohydrates. In practice it will be found advisable to vary the different forms of bread. A patient very soon tires of the same article.

Next to bread the greatest trouble will be found with potatoes, which con-

tain very large quantities of starch. It is impossible to find anything that is a palatable substitute. The diabetic must, however, conclude to do without potatoes.

All vegetables and fruit containing a large amount of starch or sugar are forbidden. The various articles will be mentioned in the diet-tables at the end of this article. Green and fresh vegetables, such as cabbage, cucumber, spinach, lettuce, celery, etc., may be eaten.

In the way of fluids, the patient may take water, milk, tea and coffee (both without sugar), and alkaline waters. On the whole, it is better to warn against the use of alcoholic stimulants, unless there is an especial craving for them, and then they should be permitted only in very small quantities. Sweet and sparkling wines should not be taken; neither should porter, rum, or gin. There is some difference of opinion as to the propriety of recommending milk in any but very small quantity. The "skim-milk" treatment has fallen into disuse. Founded on error, it fortunately did not live long.

It is impossible to say in any given case to what extent the changed diet will aid in abating the distressing symptoms, and how long any improvement brought about is likely to last. Too frequently the treatment is carried out in so imperfect a manner that only the slightest beneficial effects are to be obtained. In the great majority of cases, if the treatment is carried out with skill on the part of the physician and with resolution on the part of the patient, striking results will be attained, so that even the most ignorant soon begin to recognize the value of the restriction of diet. In advanced cases it may not be advisable to put a patient under too restricted a regimen, as profound nervous depression may result.

The sometimes almost devouring hunger for forbidden articles was well exemplified in a case of diabetes of six years' standing, in which the patient would on every possible occasion steal food from her own table to consume after retiring at night. The extreme cunning displayed by these patients in many ways quite equals that met with in hysteroids.

**Hygienic Treatment.**—The diabetic should always wear flannel underclothing. The skin should be bathed regularly with warm water and alcohol, and when practicable the passing of the winters in a warm climate is desirable.

**Medicinal Treatment.**—In treating a case of diabetes, it is important first of all to make accurate observations as to the quantity and quality of the urine. These should extend over several days, and during this period the patient may be allowed to go on with his ordinary diet. Then he should be put on a proper diet, and after a further course of observation as to the characters of the urine we are in a position to say to what extent a proper dietetic regimen is likely to benefit our patient, and whether any supplementary means are needed to reduce the amount of sugar in the urine to zero. It is only in this way that we can gain a satisfactory insight into the severity of the case and judge in a general way of the ultimate prognosis.

When we meet with a case of diabetes in which sugar does not entirely disappear from the urine under a strict diet, we may have recourse to various me-

dicinal agents as supplementary measures. By far the most important of these agents is opium. Authorities differ as to the most desirable preparations, some recommending a preparation of the crude drug, others one alkaloid and still others another of the alkaloids. Many contend that codein is preferable to morphin, but we are not aware that there is any trustworthy evidence to settle this disputed point. Codein probably agrees better with most diabetics than morphin, being less liable to disturb digestion. It is necessary to give opium, no matter in what form it is administered, in fairly full doses. It is well known that diabetic patients tolerate large quantities of it.

The plan generally followed in regard to the administration of opiates is to withhold them until a thorough trial has been made of a restricted diet. If it be found that in spite of such restriction the urine still contains a quantity of sugar, then codein or morphin should be given, at first in moderate and then in large quantities. It will almost invariably be found that a further considerable reduction in the amount of sugar in the urine is effected. One single large dose at bed-time may be all that is necessary to obtain the fullest beneficial influence of opium. Codein can be given in doses of from gr. ss to gr. x (0.032–0.65), or even more, in the twenty-four hours; morphin in doses of from gr. $\frac{1}{4}$ to gr. ij (0.016–0.13) in the twenty-four hours, or in divided doses. Albuminuria is generally considered to be a contraindication to the employment of opium, but on this point there is difference of opinion. In all severe, especially in acute cases, the effect of opium is only temporary, and, as a rule, the drug has to be given up. In the chronic diabetes of the aged it can be administered for an indefinite period in moderate quantities.

*Alkalies in Diabetes.*—The alkalies in the form both of the natural mineral waters and of the ordinary salts are extensively prescribed in diabetes. There is a general impression that they have a distinct power in lessening the glycosuria.

Of the natural mineral waters, those of Carlsbad and Vichy are most frequently prescribed. No satisfactory explanation of their mode of action in diabetes is known, although many hypotheses have been advanced. They certainly tend to lessen the distressing thirst and dryness of the throat.

Sodium or potassium carbonate or bicarbonate may be used instead of the natural salts.

*Arsenic* is an old remedy for diabetes. Its use has some scientific grounds, as it has been experimentally proved that arsenic diminishes the formation of glycogen when administered to animals. It is especially recommended in the form of the bromid. What is known as Clemens' solution of bromin arsenite is a favorite formula. Martindale, in the Extra-Pharmacopeia, gives the following directions for the preparation of this solution:

| | |
|---|---|
| Potassium carbonate, | 60 grains (4.); |
| Arsenous acid, in powder, | 60 grains (4.); |
| Distilled water, | 10 ounces (300.). |

Boil until dissolved. When cold, add

Distilled water, sufficient to make 12 ounces (360.);
Bromin, 120 grains (8.).
Set aside until it decolorizes.

*Dose.* From one to three or five drops, once or twice daily.

Iron arsenite is another preparation of some value. It is doubtful whether any permanent beneficial effects are obtained from the use of arsenic in any form of diabetes, certainly not in the severest types of the disease.

Antipyrin and agents like it are frequently recommended in the treatment of diabetes, but, like many other drugs lauded for their influence upon the disease, they have not sustained the early accounts of them. The salicyl and carbol compounds have also been used, but with no permanent benefit. For some time it was thought that in jambul we had acquired an agent of permanent value, but it too has been found of little service.

The diabetic has not escaped the latest craze—serum-therapeutics. Now it is the fashion with some physicians to treat all their diabetics with pancreatic extract. No doubt, this will soon be relegated to the dead past.

It would serve no useful purpose to even mention the numerous other agents that have been at one time or another recommended as of value in diabetes.

**Symptomatic Treatment.**—Symptomatic indications often arise in the course of this distressing disease. The thirst, which is so often troublesome, is generally best relieved by those measures that lessen the amount of glycosuria, for as a rule the thirst is proportionate to the amount of sugar in the urine. A weak alkaline water such as Vichy or Apollinaris water will usually afford marked relief. For the prevention of stomatitis a carbolic-acid lotion of the strength of about 1 per cent. should be frequently employed as a mouth-wash and tooth-wash.

To allay the craving for food we have no better agent than opium, or a little alcoholic stimulant. For the constipation the following pill at night, followed by a gentle saline in the morning, will usually be effective:

℞ Extracti cascaræ,
Extracti aloes, āā gr. j–ij (0.065–0.13).
M. et fiat pil.

For the cutaneous irritation, a tepid bath once or twice daily, followed by the external application of diluted alcohol, will prove soothing, and will further tend to prevent furuncles.

*The Treatment of Diabetic Coma.*—Nothing definite is known as to the true nature of diabetic coma. Various views have been advanced to explain the occurrence of this nearly always fatal phenomenon. A view frequently advanced is that it depends on decreased alkalinity of the blood, and to counteract this the injection directly into a blood-vessel or under the skin of a quantity of an alkaline solution is recommended. A 1 or 2 per cent. solution of sodium bicarbonate has been used, as has also a solution of a mixture

of sodium chlorid and sodium phosphate having a specific gravity of 1020. With the exception of perhaps one case the effect has, in my experience, been at best temporary. Another view advanced to explain the coma is that it arises from the absorption of toxins from the alimentary canal, and to overcome this it is proposed to give repeated doses of some quickly and generally active purgative, followed by an antiseptic such as beta-naphthol. I am not aware of any evidence tending to support the value of such treatment. It is said that both before and during diabetic coma numerous tube-casts can be found in the urine, and it is claimed that their appearance is a sign of approaching coma. Should casts appear in the urine it would, I believe, be appropriate to give the patient repeated doses of a quickly acting cathartic, and at the same time to administer some alkaline agent internally. The theory formerly advanced that diabetic coma is due to the presence of acetone in the blood has been discarded.

**Diet.**—The following dietary is recommended by Sir Wm. Roberts for diabetics:

*Sanctioned:* Butchers' meat; poultry and game; fish; cheese; eggs; butter; fat and oil; broths, soups, and jellies made without meal or sugar; cabbage, endive, spinach, broccoli, Brussels spouts, lettuce, onions, watercress, mustard and cress, celery.

*Substitutes for bread:* Bran-cake, gluten-bread, almond-meal, rusks, and biscuits; "torrefied" or charred bread.

*Beverages:* Dry sherry, claret, bitter ale; brandy and whisky (in small quantities); tea, coffee (no sugar), chocolate (made with gluten-meal), soda-water, potassium-bitartrate water.

*Forbidden:* All saccharine and farinaceous foods; bread, potatoes; rice, tapioca, sago, arrowroot, macaroni, etc.; turnips, carrots, parsnips, beans, and peas; liver (contains much sugar-forming substances), and therefore oysters, cockles, mussels, all containing enormous livers; the pudding of crabs and lobsters; all sweet fruits, as apples, pears, plums, gooseberries, currants, grapes, oranges, etc.

*Beverages:* Port and all sweet wines; sweet ales and porter; rum and sweetened gin.

The following is the dietary of Purdy:

*Foods permitted:* Meats of all kinds except livers,—beef, mutton, pork, poultry, game; either fresh, roasted, broiled, dried, smoked, cured, potted, or prepared in any way, except with sugar, flour, or prohibited vegetables. Soups made from meats without flour and excluded vegetables. Fish of all kinds, except oysters, and the inner parts of crabs and lobsters. Eggs, butter, cheese, and oils. Jellies made from Cox's gelatin, unsweetened except with saccharin. Spinach, lettuce, olives, cucumbers, summer cabbage, mushrooms, Brussels sprouts, and watercress. Almonds, filberts, walnuts, cocoanuts, and Brazilian nuts.

*Beverages:* Water, including all mineral waters, Rhine wine, California Riesling and Chablis, New York and Ohio Catawbas, Budai Imperial, Schreiber's "dietetic wine," whisky, and gin.

*Foods prohibited:* Common bread, except as specified later; biscuits, crackers, and cakes. Farinaceous articles, such as potatoes, rice, sago, tapioca, macaroni, vermicelli, common flour, oatmeal, corn-meal, buckwheat-flour, barley-meal. The livers of all animals. Saccharine vegetables, as turnips, carrots, parsnips, peas, beans, beets, onions, and rhubarb. Blanched vegetables, as celery, sea-kale, endive, radishes, and roots, fruits, and chestnuts.

*Beverages:* Tea, coffee, milk, whey, buttermilk, skimmed milk, chocolate, cocoa, malt liquors, cider, champagne, sauternes, sherry, port wine, Madeira, and all sweet wines and liquors.

I believe it to be quite unnecessary and perhaps even injurious to forbid patients taking tea and coffee as directed in Purdy's list. Milk, buttermilk, whey, can also, I believe, be taken in small quantities with impunity.

## Diabetes Insipidus.

Idiopathic diabetes insipidus is a disease or state about which we know little or nothing. It must be considered as distinct from the symptomatic form in many cases, but we occasionally meet with instances in which it is impossible to say with which of the two we have to deal. The latter is a not infrequent symptom of certain organic and functional nervous affections. In all probability, the so-called idiopathic form is also a result of some intimate nervous change or disturbance. The treatment of the disease is therefore of necessity a matter of empiricism, and is seldom satisfactory. Many cases, however, recover completely, either under treatment or spontaneously. Valerian has for a long period been much employed, but whether or not it exerts a definite influence upon the disturbance has not been proved. Ergot has been recommended by Da Costa and others. Many cases have been reported in which this drug quickly exerted a favorable influence and even cure. It should be employed in full doses, one dram (4.) of the fluid extract two or three times daily. Opium has not the same marked effect in this disturbance as it has in saccharine diabetes. Antipyrin is considered to be very useful, but recent experience has not borne out the early favorable effects published in regard to it. Arsenic, phosphorus, oxygen, pilocarpin, and the bromids are also recommended.

**Dietetic Treatment.**—There is no useful purpose subserved by limiting the amount of fluids or solids consumed by the patient. It is not only cruel but dangerous to limit the amount of fluid. The free use of fluids is likely to be productive of good rather than harm, as by their use we get rid of effete matters. The patient may be allowed to take all the water he desires, or any weak alkaline water if preferred to simple water. Stimulants are, as a rule, better withheld. I am not aware that any limitation of or change from an ordinary mixed diet is likely to do any good.

**Hygienic Treatment.**—The patient should wear woollen underclothing during all seasons. The action of the skin can also be stimulated by the regular employment of warm baths. In this way the comfort of the patient is promoted, and the cleanliness is a preventive of the various forms of dermatitis which are so commonly met with when this precaution is not taken.

# SCURVY; PURPURA; HEMOPHILIA.

By JAMES STEWART.

## Scurvy.

Although scurvy has become a very rare disease in nearly all civilized countries, through a proper understanding of its mode of origin, cases are still encountered, among both the rich and the poor. Occasionally cases are met with among the poor, and it is not uncommon to find the disease in those who work in the lumber-camps of the tributaries of the Ottawa River. Osler says it is not uncommon among the Hungarian, Bohemian, and Italian miners of Pennsylvania. Northrup refers to a number of cases occurring in children fed almost entirely on proprietary articles of food.

Scurvy is due to the want of fresh vegetables in the dietary. Exactly what this want is has not as yet been found out. Some attribute it to a deficiency in the salts of potassium, others to the absence of organic salts. Bad hygienic surroundings and a depressed mental state are contributing causes.

Scurvy can be prevented by a generous, mixed diet. When it is recognized, it speedily yields to proper dietetic treatment. Cases are now and then found that prove fatal, but early diagnosis, followed by appropriate treatment, should prevent a fatal ending in all uncomplicated cases. I have seen three fatal cases occurring in a public institution, but the condition had not been recognized during life. In all three there were multiple hemorrhages in the brain.

The proper preventive treatment consists in abundance and variety of fresh vegetables. Lime-juice may be used when vegetables are not procurable. The same treatment is quickly efficient when the disease has developed. A salt of potassium is also an aid in promoting recovery. Iron is of value, but quinin should not be given, as it only tends to aggravate the condition.

Warm baths should be employed daily, but the practice of recommending massage while there is a tendency to hemorrhage is, I believe, fraught with a certain degree of danger.

## Purpura.

The various forms of purpura usually described in text-books include the simple variety, in which a few or more subcutaneous hemorrhages are all that is present; rheumatic purpura, in which in addition there exists multiple arthritis; and purpura hæmorrhagica, in which, besides extensive cutaneous hemor-

rhages, there occurs bleeding from various mucous membranes and into internal organs. The first two forms are generally of comparatively slight importance and pass away under appropriate diet and tonic treatment; purpura hæmorrhagica is, however, frequently a serious affection.

The first matter to attend to in all cases is to see that the patient receives an abundance of food, properly cooked. A great many internal remedies are in use, including arsenic, ergot, the tincture of ferric chlorid, quinin, lead acetate, turpentine, etc. When acute multiple arthritis is a prominent symptom, the administration of the salicyl-compounds is called for. In purpura hæmorrhagica, in addition to the usual surgical measures employed to arrest the bleeding, some writers consider the internal use of saline purgatives of great value as tending to bring about coagulation.

### Hemophilia.

The cause of this strange peculiarity is unknown. Nothing can be done to remove the tendency to bleeding. The effects of the loss of blood can in a measure be fortified against by judicious regulation of the general health through appropriate dietetic measures and general hygiene. The treatment otherwise is purely symptomatic. Fresh air, judicious exercise, and a diet not too rich in nitrogenous food are called for. It is, of course, very necessary to warn the parents about the dangers of even slight injuries. The extraction of teeth should be always avoided. As the treatment for the arrest of the bleeding is mainly surgical, I shall here only briefly refer to bleedings from internal parts. Hemorrhage from the bowels is the chief of these. Opium and the external application of ice to the abdomen, and also the injection of cold water into the bowel, are the chief measures to be relied on.

For bleedings from the respiratory mucous membranes, opium, or preferably a mixture of morphin and atropin, together with the administration of ergot, either by the stomach or hypodermically, is our most useful measure.

The arthritis that is sometimes met with in this disease calls for rest and anodyne applications.

# DISEASES OF THE MOUTH, PHARYNX, ESOPHAGUS, AND CONTIGUOUS PARTS.

By ERNEST LAPLACE.

## Diseases of the Parotid Gland.

Traumatic lesions of the parotid gland generally involve important structures, such as the carotid artery and the facial nerve, which are situated in the neighborhood of this organ. The inflammatory processes that may invade this region, though due to traumatism, generally result in involvement of the aponeurosis of the parotid gland, and they may be followed by other inflammatory processes, as occurs in an abscess. The treatment of this condition consists in thorough antisepsis, or, if there be the necessity for it, an incision to remove whatever purulent accumulation may have taken place. Very little significance should be placed upon a salivary fistula in this region, as its existence is rather theoretic than the result of actual experience; great importance should, however, be placed upon a wound of the excretory canal of the parotid, Stensen's duct. This, which is made up of two principal branches, leaves the anterior portion of the parotid between the superior and middle thirds, passes horizontally on a level with the orifice of the nostril, on the anterior border of the masseter, and opens into the buccal cavity on a level with the second superior molar. A blow delivered directly upon the cheek, in a vertical direction, may wound Stensen's duct. It often happens that a wound produced by a sharp instrument will sever the duct and will heal by first intention, and the lesion be, as it were, unnoticed. Should the wound be a penetrating one, it can be repaired externally, uniting mucous membrane to mucous membrane and skin to skin, and perfect restoration of the part may result. Very seldom is there a permanent fistula. However, a permanent fistula may result when the duct opens as a lip into the skin. The methods employed for the cure of a salivary fistula of Stensen's duct are complicated plastic operations, for a full description of which works on surgery should be consulted. However, it has been advised, when all other means fail in repairing the continuity of the duct, that an attempt be made to induce atrophy of the parotid. In certain animals it has been found that a ligature of Stensen's duct results in such atrophy.

## Inflammation of the Parotid Gland (Parotiditis).

Inflammatory processes of the parotid are catarrhal conditions of the parenchyma and of the salivary ducts, and in the majority of instances the starting-point is in the excretory canals of the gland, as a result of the retention of

saliva within them, finally leading to suppuration. There is no doubt that parotiditis may result from extension of inflammatory processes from the mucous membrane of the mouth; may also occur as a result of erysipelas, and likewise of the extension of mercurial stomatitis; it sometimes follows simple nasal catarrh.

The disease commonly called mumps, or infectious parotiditis, which prevails especially during the spring and autumn, finds a local development more especially in the parotid gland, and produces a catarrhal inflammation therein. There is at first fever, which follows a rather acute course, then metastasis to the testicles, rarely to the genital organs of a woman, but sometimes to the breasts. It is rare that the surgeon has to interfere in cases of parotiditis, for it is only exceptional that this condition proceeds beyond the catarrhal stage and gives rise to the formation of an abscess.

Mumps as such is contagious. It is possible that the infectious agents are present in the atmosphere, and enter the salivary ducts through the mouth, reaching the parotid, and there producing an acute inflammation which spreads by metastasis to other organs. In another series of inflammations the infectious organisms may reach the gland through the circulation; such are the forms of parotiditis that result from pyemia and septicemia or typhoid fever, small-pox, scarlatina, cholera, etc. It is questionable, however, whether this infection always takes place through the circulation. No care having been taken to clean the mouth, it is barely possible that the infection may have reached the gland through this avenue.

The onset of the inflammation is constant in its clinical symptoms. Patients complain more or less of pain in the parotid region and of an inability to open the mouth freely; a certain tumefaction invades the parts, giving a very characteristic appearance to the face; the hearing is impaired, owing to swelling of the Eustachian tube.

After this first period the symptoms vary according to the etiologic factors. Epidemic parotiditis, as an ordinary catarrh of the gland, would disappear in about eight days, at the same time as the general symptoms of the disease. When, however, there is no cessation in the general symptoms, the tumefaction persists; the skin covering the glands becomes edematous, the fibrin increases the tension of the aponeuroses, and the disease may terminate in different ways according to its intensity. The aponeurosis covering the anterior portion of the gland is rapidly destroyed by suppuration, particularly if the disturbance is due to an infectious process, and results in an abscess, with a discharge of detritus and mucus and with a foul odor from the cavity. When the process develops with less intensity a more benign abscess is the result, but even here pus and broken-down connective tissue come from the cavity. The formation of an abscess on the anterior portion of the parotid should be considered as a favorable termination of this condition, for the inflammatory processes involving the posterior region of the parotid may give rise to very serious symptoms. The posterior portion of the gland in the region of the styloid process is in relation with the interstices of connective tissue, which are very

favorable to the propagation of inflammatory disease. The different muscles of this region, the stylo-pharyngeus, the stylo-glossus, and the digastric, favor propagation of the pus either toward the posterior portion of the neck or else toward the hyoid bone and the mediastinum, so that purulent inflammation may arise behind the pharynx and the esophagus. Pus may insinuate itself along the air-passages and find an exit about the hyoid bone. The extension of the inflammation to the head presents the most dangerous prognosis. Meningitis has resulted from such a condition, and is usually caused by the propagation of the inflammation along the connective tissue surrounding the vessels and nerves, though sometimes it may result from a thrombus being taken up from a suppurating gland.

The principal purpose in the treatment should be to prevent these complications, and when they have taken place to mitigate their consequences by prompt intervention. Ordinary forms of parotiditis subside readily without much treatment. If the swelling does not tend to disappear, but rather to increase, and is associated with excessive pain and fever, prevention of the development of pus should be aimed at by continued local applications of the ice-bag. The same treatment should be followed in the case from the time that suppuration is suspected. It is thus often possible to limit the inflammation; but if, in spite of this treatment, suppuration increases, there should be no hesitation in making a deep incision, even should the pus not already have perforated the aponeurosis. Such an incision should be made, with the utmost antisepsis, as nearly as possible in a direction parallel with the blood-vessels and the facial nerve, or at a certain distance from the usual situation of these, and the wound should be drained, covered with antiseptic dressing, and packed, preferably with iodoform-gauze. The wound should be dressed daily, sterilized with hydrogen dioxid, and allowed to granulate.

Very often inflammations of the parotid leave as a result certain indurations that may become the seat of neoplasms. To prevent these fibrous developments it is well to administer potassium iodid and also to apply a compressive bandage. Another cause of parotiditis already mentioned is found in foreign bodies, such as salivary calculi, in the salivary ducts. Concretions form in Stensen's duct, and may attain large dimensions; they have often been found as large as a pigeon's egg. Obliteration of Stensen's duct may give rise to a salivary tumor.

### Tumors of the Parotid Gland.

The vast majority of the tumors of the parotid that have to be diagnosticated and treated belong to the series of neoplasms of connective-tissue type known as "sarcomata."

Sarcoma of the parotid is characterized by being surrounded by a capsule and by its slow growth, and when it is operated upon it behaves as a benign tumor. There are four kinds:

(1) Pure sarcoma. This is encapsulated, as are all of the sarcomata of the parotid, and its size is variable, rarely exceeding that of a pigeon's egg. It is

rounded and has smooth surfaces; microscopic examination reveals, as a rule, spindle-shaped cells, but sometimes small round cells.

(2) In this class may be comprised certain other forms, such as angio-sarcoma, alveolar sarcoma, cylindro-sarcoma, fibro-sarcoma. These give rise to rounded tumors; some are nodular and reach the size of a fist; sometimes they are both hard and soft in different portions. On section they appear yellowish white and present a fibrillar aspect. Between the bundles of fibers are seen islands of cells projecting on the surface like small granulations. Sometimes a lobulated appearance is present. These tumors likewise contain small cells and also spindle-cells; they possess a capsule, do not return after excision, and produce no metastasis. They grow very slowly.

(3) Myxosarcoma. This tumor reaches the size of a child's head. It is soft, rounded, and encapsulated. It is pure white in color, with yellowish or reddish points, and has often a hemorrhagic aspect. Histologically it consists of round granular cells and some spindle-shaped cells.

(4) Chondrosarcoma. This is nodular, of variable size, and possesses a capsule. The little nodules are hard, whereas the larger ones, as a rule, are softer. The capsule sends fibrous ramifications within the center of the growth. The stroma is filled with homogeneous tissue of a whitish appearance, while cartilage appears within it as lobules about the size of a pea. From the histologic standpoint this sarcomatous tissue manifests a plexiform disposition, tending toward cartilaginous and myxomatous fibrous tissue. It is difficult to state positively that any of these tumors will always retain its original type. Their disposition is rather to progress in time toward a more rapid development; hence the necessity of early diagnosis; and whatever the original type, recourse to extirpation is indicated. The only risk is that of wounding the facial nerve.

**Tumors arising from the Glandular Substance of the Parotid.**—Chief among these tumors is carcinoma. This is of rapid development, with very little stroma, rather soft, and consists mostly of endothelial cells of the acini of the gland. The development is sometimes uneven, so that there are depressions and nodulations upon the surface; however, the rapid growth ensures its softness. Carcinoma develops after the fortieth year. Sometimes, but very exceptionally, it is of slow development. In such cases the tumor partakes at first of both the sarcomatous and the carcinomatous type; the earlier the latter tendency is manifested, the more rapidly does the tumor develop and become softer.

The prognosis is very bad, and is worse in direct ratio of the rapidity of development.

Complete extirpation of the gland offers hope of permanent relief but very seldom, and this is when the operation is performed early in the development of the tumor.

A **lipoma** may develop below the aponeurosis of the parotid gland, and be of slow development. At first it would be difficult of diagnosis. As a rule, it is quite limited and develops independently without infringing upon

the neighboring structures; it other words it does not resemble a swelling of the parotid, and this point is of great value in diagnosis. The more limited a tumor, the less likelihood of its having originated directly from the gland and having invaded its substance proper. This being the case, the diagnosis would from the first be that of a growth of benign character. An uneven tumor existing in an aged person and spreading from the gland must therefore be considered as carcinomatous, being quite the opposite in behavior to a lipoma. Should this condition be accompanied by metastasis in the neighboring lymphatic glands, there would be no doubt as to the diagnosis. In this locality more than anywhere else have tumors of a benign character at first been seen to suddenly undergo malignant transformation. A tumor of the parotid, at first isolated from the other parts of the gland, but more or less circumscribed, tends to spread; on the contrary, a tumor that constantly increases in size finally assumes from the operative standpoint all the malignancy of a diffuse tumor. For this reason all growths in the neighborhood of the parotid should be removed as soon as possible, always bearing in mind the danger of wounding the facial nerve.

Not the least among the results of wounding the facial nerve, and its paralysis, is the inability to close the eyelid on that side, and hence the dangers resulting to the corresponding eye. Ulcerative keratitis has been shown to result from the continued exposure of the eye.

In performing the operation, as hemorrhage is the most serious condition to be dealt with, it is often wise to ligate the carotid artery as a preliminary step, though authors are not unanimous on this point. Many surgeons do not remove the aponeurosis of the parotid, whereas others remove the whole of the capsule with the gland.

It is rare for the other salivary glands to be the starting-point of tumors. The submaxillary glands, however, are the oftenest affected, but this only by retention-cysts.

### Cysts of the Parotid.

Cysts of the parotid are not rare in the tumors just described. They sometimes result from obliteration of the canaliculi of the gland by a neoplasm, and are thus retention-cysts. In other cases they represent inflammatory processes and obstructions of the small canaliculi. These cysts are situated in the interior of the gland and are difficult of diagnosis. Their contents are often serous, and the cysts are rarely of large dimensions. Atheromatous or sebaceous cysts are also observed in this locality, most commonly in the anterior portion of the gland.

The diagnosis of cysts sometimes necessitates the use of the trocar.

It has been advised to attempt their cure by the injection of tincture of iodin. This treatment may of course prove successful, but in the present state of surgery no better or more rational treatment can be resorted to than direct incision and scraping and packing with iodoform-gauze, permitting granulations to form from the floor to the surface.

### Abscess of the Maxillary Antrum.

This condition is generally the result of a periodontal inflammation propagated to the mucous membrane of the antrum. Depending upon the nature of the irritant (bacteria) will the symptoms be of a more or less acute character. A diseased tooth is generally the source of offence, in which case it is to be removed and the antrum is to be drained through the alveolus. A 2 per cent. solution of carbolic acid injected into the antrum will materially diminish the suppurative process. If, however, a constitutional cause be at the bottom of the suppurative process, this cause must be sought out and the proper treatment, specific or symptomatic, be applied. Should necrosis or caries have ensued, care should be exercised in chiselling or curetting out the cavity in order that all diseased tissue may be removed. The opening of the alveolus having been enlarged, it must be packed with iodoform-gauze, so as to disinfect and drain thoroughly. This packing should be renewed daily, on account of the foul condition that would otherwise soon be generated by the bacteria of the mouth.

Teeth are sometimes found imbedded in the mucous membrane of the antrum, and may become a source of irritation, eventually developing a cyst, which at first might be taken for a neoplasm. Felt in the canine fossa, it is hard and elastic. As there is little or no inflammatory area this condition is rather free from pain. An incision will pass through a cartilaginous cyst-wall containing muco-gelatinous fluid and the non-erupted tooth.

Tumors originating in the antrum are almost invariably sarcomatous, and are manifested by obscure pains about the cheek and mouth. When they attain considerable size they show themselves as protrusions through the nostril or as a swelling about the roof of the mouth. In cases of sarcoma of the antrum it is useless to operate except in the earliest stages of the disease, as recurrence is otherwise almost sure to take place. Nothing short of the complete removal of the antrum, including every portion of the superior maxillary bone, will afford the patient any degree of safety.

### Lips.

**Furuncles and fissures of the lips** occur principally among the scrofulous. They may exist on the surface of the lips or about the frenum, and they will disappear as a result of cauterization with silver nitrate. Among the scrofulous there is a tendency to swelling of the upper lip as a result of chronic inflammation leading to abnormal tissue-development. This inflammation is due to an infectious process starting from a fissure in the upper lip. Fissures may also result from wounds of the lips inflicted by carious teeth.

The treatment will consist in destroying the source of irritation, be it primarily a fissure or a slight abrasion caused by a tooth. In chronic edematous swelling of the upper lip relief has been afforded by compression applied directly to the part by an india-rubber band about the width of the lip and

secured at the back of the head ; the lip is thus compressed against the teeth, with a disappearance of the inflammatory process.

The glands of the mucous membrane of the lip may become hypertrophied to such an extent that the lip is twice or three times its natural size. Behind the upper lip appears another or second lip, as it were. This defect can be remedied by resecting the lip and uniting the flaps by sutures.

Among the **tumors of the lips** that require special mention are angiomata and carcinomata. *Angiomata* appear more frequently about the free edges of the lip, and, owing to the loose character of the tissues, are rapid in development. They sometimes undergo a transformation from a purely venous character into a genuine arterial condition, and thus may invade the neighboring tissues.

The treatment must be mainly directed toward maintaining the normal form of the mouth. The smaller tumors may be extirpated. Care must always be taken to provide sufficient skin from the neighborhood to furnish a flap for the denuded surface. The larger tumors should not be excised, but should be cauterized with the thermo-cautery or the galvano-cautery at repeated sittings, until the mass of the tumor has been transformed into cicatricial tissue, which can be dissected out without fear of hemorrhage.

*Carcinoma of the Lip.*—The favorite seat of carcinoma of the lip is the lower lip. The neoplasm is in this situation about twenty times more frequent in men than in women. It is probable that the smoking-habit has something to do with the development of carcinoma of the lower lip, for this often begins at the very spot where the pipe or the cigar has generally been held—that is, on one side or the other of the center of the lip. Syphilitic ulcerations, on the contrary, appear about the commissures of the lips, and do not present the irregular and ragged appearance of carcinoma. The history and microscopic examination will finally clear the diagnosis. The carcinoma has a progressive course: it destroys the labial tissues, and it finally invades the bones after the destruction of the soft parts. The lymphatics are infected, and there is metastasis in distant tissues. Under the chin especially are enlarged glands to be found and also in the submaxillary region.

Operation must be resorted to before the lymphatic glands have been infected. The tumor, with at least a centimeter of extra healthy tissue, should be removed.

## The Mouth.

**Stricture of the Buccal Orifice.**—Syphilis, lupus, noma, and various ulcerative processes may produce such a formation of fibrous tissue about the buccal orifice as will result in cicatricial contraction. Burns by fire or by the caustics, acid or alkaline, may result in the same deformity. The chief indication for intervention in this condition is the difficulty that attends the ingestion of food, not to speak of the repulsive expression of the face. Patients would finally starve without proper surgical intervention.

The treatment of mild cases is generally unattended with difficulty, and consists simply in incising the cicatricial connective tissue between the upper

and lower lips. In more aggravated cases Dieffenbach enlarges the buccal opening to the point at which he wishes to locate the new commissure, and then covers the edges of the wound with a mucous flap taken from the lip or the cheek.

**Stomatitis.**—*Aphthæ* are small white ulcerations, generally occurring in children under three years of age, and accompanying some febrile condition. Not much importance need be given to aphthæ, inasmuch as they disappear with the improvement of the general condition. A mild astringent wash will suffice for their control.

*Thrush*, or *parasitic stomatitis*, develops in a class of children whose constitution is debilitated. It is due to the local growth, in the mucous membrane of the mouth, of the *Oïdium albicans*. The disease, which is quite superficial, is manifested by the appearance of white spots of thickened and softened epithelium of the mucous membrane about the tongue and the cheeks, where the parasite abounds.

General hygienic measures, together with thorough treatment of the system according to the indications present, are essentially required as the primary measures in the successful treatment of thrush. Locally, a wash consisting of sodium bicarbonate, gr. x (0.65), and water, f℥j (30.), will suffice to hinder the development of the fungus.

*Mercurial stomatitis*, or inflammation of the mouth, results from intoxication from an overdose of some mercurial salt, or from the accumulation of mercury within the system in consequence of its continued use. Salivation and an irritative state of the mucous membrane of the mouth and gums form the main symptoms, together with a painful condition of the teeth. The angry and swollen condition is likely to extend as far as the esophagus.

The immediate withdrawal of all mercurial salts is the first indication in the treatment of the morbid state. A mouth-wash and gargle consisting of potassium chlorate, gr. xv (1.) to the ounce of water (30.), should be used frequently throughout the day and night until the condition subsides. The best food must be provided for the patient, lest he fall into a condition of marasmus. If, while the ulcerative surface is undergoing cicatrization, the inflammation have gone on to ulceration, good results in preventing the formation of contracting scars may be obtained by frequently moving the inferior maxillary bone; but when the mucous membrane has become ulcerated over a large area it is rare that we can succeed in preventing grave cicatricial contraction.

Mercurial stomatitis often presents an evident analogy to the morbid process known as *noma*. It is even probable that a number of gangrenous ulcerations of the mouth, formerly known as "aqueous cancer" or as "noma" can be considered as inflammation of mercurial origin.

**Noma** is a form of phlegmonous inflammation of the face, observed principally among children ranging from two to twelve years; it is rare among adults. It attacks the debilitated, but especially those having suffered previously with some debilitating affection, such as scarlet fever, measles, or

typhoid fever. This gangrenous inflammation always begins in the mucous membranes of the lips or the cheeks, spreading in depth and superficies, and reaching the skin, where a dark spot appears, surrounded by an inflammatory area. This spreads gradually over the whole surface of the face, the tissues becoming gangrenous and foul and the nose and eyes being invaded. Febrile symptoms set in, and there results a general septic infection. When the process stops the line of demarcation becomes plainly visible; the ulcerated tissue sloughs off, and an abundant granulating process begins, which ultimately results in very disfiguring scars. About 70 per cent. of the cases terminate fatally either from exhaustion or from septicemia. Pneumonia may occur as a complication, and may terminate disastrously, although the gangrenous process may already have ceased.

The treatment of noma is the same as that of hospital gangrene, to which it is analogous. Having removed the sloughing tissues with the curved scissors, the wound should be cauterized, preferably with the thermo-cautery. A concentrated solution of zinc chlorid has been found very serviceable on account of its deep action and the ease of its application. With a cotton pledget the solution is applied for from eight to ten minutes over the surface to be cauterized. It has lately been suggested to employ hypodermic injections of a 2 per cent. solution of carbolic acid around the periphery of the inflammation, in order to control its spread. Along with this the greatest care must be given to providing the best hygienic conditions for the patient, especially his removal from a damp atmosphere, and giving a tonic treatment, with good food, etc.

**Abscess of the buccal cavity** may result from infection of the follicles of the mucous membrane. It may also arise about the gums as a result of infection from a tooth. Such an abscess should be incised, and after the use of a mouth-wash such as potassium chlorate, gr. x (0.65) to water f℥j (30.), it will usually heal without further trouble.

## Salivary Calculi.

Salivary calculus is the result of the deposit of the solid materials of the saliva about the neck of the teeth, and also in the various salivary ducts. It has been given the name of "tartar," and it consists mostly of calcium carbonate and phosphate. When forming in Stensen's duct a bulging or cystic tumor in which a hard body can be felt appears against the second molar tooth of the upper jaw. The orifice of the duct need not necessarily be closed. Calculi are also found in the sublingual ducts, where, if they give rise to complete obstruction, they will occasion cystic distention of the floor of the mouth. They are not infrequent in Wharton's duct, where they often result in a swelling of the submaxillary region from the retention of saliva.

The treatment of such a condition, as well as of that known as "ranula," which is simply a retention-cyst containing saliva (due to an inflammatory obstruction of a salivary duct), consists in incision of the tumor and evacuation of its contents. The parts are anesthetized by means of a 4 per cent.

solution of cocain, and the tumor is cut down upon. When a calculus is present, it is an indication for the line of the incision. Should the calculus be near the orifice of a salivary duct, this orifice should be sought for and be dilated if possible, for the removal of the calculus. If, on the contrary, the orifice cannot be found, an incision is made directly upon the calculus. When the duct is simply opened, no after-treatment is required except keeping the mouth clean with an ordinary mouth-wash, such as a solution of potassium chlorate, gr. x (0.65) to f℥j (30.). Should a large cyst or ranula be incised, the cavity should be thoroughly emptied and cleansed and then be packed with iodoform-gauze, one end of which is fastened to the cheek with plaster, so that the packing may not become detached and be swallowed. When granulations begin to fill the cavity the wound may be left alone, insisting, however, on careful cleansing, to remove whatever particles of food may find entrance to the wound. The wound will close in due time, leaving a sinus corresponding to a new salivary duct.

It has lately been advanced that the formation of tartar about teeth, as well as of calculi in the ducts, is due to the decomposition of the saliva incident to the development of certain bacteria. Hence the added necessity of preventive measures by systematic hygienic cleansing of the buccal cavity.

## Diseases of the Palate.

**Wounds of the palate** are rare, and occur mostly as the result of gunshot injuries inflicted with suicidal intent. The treatment will consist simply in the application of the principles of cleanliness. Acute inflammations, on the contrary, are quite frequent, resulting in abscesses and swelling that sometimes almost close the pharynx. Such a result is frequent in diphtheria, and may also follow the ingestion of very hot fluids. An effusion takes place in the submucous tissue, and the soft palate, especially the uvula, presents a bluish tint, owing to the congestion. The edematous condition present can readily be removed by slight scarification.

The **ulcerations** most frequently met with are due to syphilis and lupus. The palate is especially the seat of the grayish-yellow deposits characteristic of local syphilis, and these may be accompanied by condylomata around the free margins of the veil of the palate and uvula. Ulcers may also exist on the hard palate, tending to destroy not only the soft parts, but likewise to perforate the bone (perforating ulcer). Syphilitic ulceration preferably develops on the anterior portion of the soft palate, immediately above the uvula. Lupus sometimes, though rarely, develops in the same situation. When this takes place the ulcerative process has already destroyed the nose, and finally makes its way to the posterior structures. It is always doubtful at first whether such an ulceration be syphilitic or lupous. It is therefore wise to resort to the administration of potassium iodid, which will surely improve the syphilitic process to a certain degree, and leave the lupus untouched.

**Perforations** due to syphilis leave an ugly hard border of mucous mem-

brane devoid of healthy vitality, and quite unsatisfactory for the subsequent performance of uranoplasty for the removal of the deformity.

All progressive ulcerations of the palate should be subjected to treatment with potassium iodid, which seems to exert a specific action upon them, especially when they have taken a phagedenic form. Lupus must be treated here as elsewhere by local measures, that is, by the use of the knife, the curet, and the actual cautery. In addition, constant use of an antiseptic mouth-wash for purposes of cleanliness should not be omitted. Should bone have been at all attacked, all that is necrosed must be removed effectually before the soft tissues can possibly improve.

**Acute swelling of the uvula** results from exposure to cold or from an acute inflammation of the neighboring structures, and conveys the sensation created by the presence of a foreign body in the esophagus, from the organ being elongated and hanging on the base of the tongue. The condition provokes movements of deglutition and nausea. When the uvula hangs as low as the epiglottis or the glottis it provokes a continued reflex cough and hoarseness. Suffocating spells may also result, and may give rise to fears of asphyxia during the night. This condition may be associated with a certain amount of paresis of the veil of the palate, for it occurs in diphtheric paresis, and also in the last stages of pulmonary tuberculosis, when dangerous coughing spells are frequent.

This ailment is especially annoying to singers and public speakers, and a number of instruments have been invented for its relief. A simple and effective means of amputating the superfluous portion of the uvula consists of a long hook by which the body can be held securely, and a pair of sharp scissors. It is well to hold the mouth open with an oral speculum or with a cork inserted on one side of the mouth between the molar teeth, and with one cut, having hooked the uvula at its extremity, the redundant portion is removed. A mild astringent gargle will effectually check the hemorrhage.

The veil of the palate sometimes remains adherent to the pharynx as a result of ulceration incident to diphtheria or to local tuberculosis. The result may be either extensive deformity causing stricture of the pharynx, or else such adhesions as would destroy the normal quality of the voice. Incidentally, taste, smell, and hearing may be impaired, according to the extent of the lesion. The evil results are especially felt during sleep, the patients being awakened by a sense of suffocation as soon as they close the mouth; on the other hand, if the mouth is open the mucous membrane of the nose, as well as that of the throat, becomes dry.

The operative treatment for the relief of this distressing condition consists in removing as much of the cicatricial tissue as may be necessary to restore the normal condition of the parts as far as may be possible. This is quite difficult of accomplishment, inasmuch as the tissues are hard and unyielding, so that the application of sutures is especially difficult, while the granulating process has a tendency to reproduce the original condition. The patient's head should hang back over the table during the operation. In certain cases,

when operative relief has been impossible an india-rubber tube or canula has been used to maintain a sufficiently patulous opening.

Better than all, however, is the preventive treatment. Ulcerations that have a tendency to lead to the formation of adhesions must always be treated by the internal administration of potassium iodid, locally by the application of caustics, and finally by the constant introduction of sounds or bougies, or by the constant use of any other means whereby the union of the veil of the palate with the pharynx may be prevented during the healing process.

Among tumors that form in the palate are angiomata and varicose tumors, which are easily diagnosticated, and require for their disappearance complete obliteration by cauterization. Dermoid cysts and mucous cysts are also sometimes found in the same situation; both are cysts by inclusion. The second are due to the presence of stray dental cells in the palatine apophyses. Simple fibromata and fibrosarcomata, as well as enchondromata, may develop from the periosteum of the palate. The most frequent tumors in this region are adenomata arising from the mucous follicles. They soon become cystic, and may even undergo calcareous degeneration. Sometimes they ulcerate and spontaneously disappear without recurrence. On the other hand, carcinomata appearing in this locality generally spread from the dental region, and so infiltrate the tissues as to make their complete removal almost impossible, and the prognosis is more unfavorable.

**Congenital Fissures of the Palate.**—These are invariably due to arrest of development. Sometimes the uvula is divided in two, or else the fissure exists in the central portion of the palate and does not extend to the uvula. The fissure may be bilateral. In that case the vomer is situated immediately above the cleft. The palatine apophyses of the superior maxillary bone may be alone divided; then the alveolar border is intact; or else there may be a double fissure, and the intermaxillary bone projects more or less in front. These fissures are attended with difficulty in phonation. When they do not arise very much above the uvula, they are not accompanied by alteration of the voice, whereas all divisions of the palate more extended than this alter in a measure the articulation of sound. In this bone-difficulty certainly consists the greatest inconvenience from fissures of the palate. Patients always learn how to overcome the defect to a certain extent, by appropriate movements of the tongue, and food is prevented from entering the nasal cavity by likewise training the tongue to close the opening. Children thus affected are exposed to the risk of bronchitis and pneumonia.

All surgical measures destined to close such fissures are classed under the heading of *uranoplasty*, which consists in dissecting off the mucous membrane and the periosteum from the hard palate, and, having denuded the edges, bringing them together gradually by means of sutures.

The palliative treatment consists in the employment of obturators whereby the fissure is closed. These are, at best, inconvenient to wear, and are liable to become loosened from their position and to be swallowed. Therefore it follows that all these fissures should be operated upon as soon as possible, for

there are no recorded cases in which the peculiarity of phonation due to the existence of a fissure has disappeared during adolescence or adult life.

As to the technic of uranoplasty and staphylorrhaphy, the proper works on surgery are to be consulted.

## Diseases of the Tongue.

There are cases on record of complete **congenital absence of the tongue.** In such cases the organ is represented by two small nodosities that are quite movable, owing to the existence of a special muscular apparatus. Loss of substance of the tongue as a result of ulceration is more frequent; it is rare, however, as a result of traumatism. The most frequent congenital deformity of the tongue is due to anomalies of the frenum. The fold of mucous membrane that extends from the tongue to the floor of the mouth is sometimes so long that the tongue seems attached to the mouth by a piece of free tape, while in other cases the frenum is so short that the tongue cannot freely execute the movements necessary for sucking or deglutition, and the inability to properly articulate is manifested as the child becomes older. The freeing of the tongue is a very simple operation. The index finger of the left hand is placed under the organ so as to stretch the frenum between the fingers, while this is cut with blunt-pointed scissors.

Traumatic lesions may result in **adhesions of the tongue** to the floor of the mouth. Lacerations of the floor of the mouth may also produce the same result. When the anterior extremity of the tongue remains free, the organ, owing to the powerful action of its muscles, can dislodge itself and regain its freedom to a certain extent. A plastic operation sometimes enables the surgeon to repair the tongue in cases of more importance.

**Traumatic Lesions of the Tongue.**—The vast majority of traumatic lesions of the tongue are caused by the teeth. Sometimes the jaws in epileptic attacks catch the tongue between the alveolar arches; sometimes broken teeth with sharp edges wound the lateral portions of the organ, causing a species of ulceration more or less serious in character. There is infiltration at the edges of the ulceration, and a yellowish or greenish discoloration of the ulcerated surface. Often such an ulcerated condition may be thought to be syphilitic, or even carcinomatous, should the causative agent be unknown. In such cases the offending teeth should be filled or extracted. There occurs in children a peculiar ulcer of the tongue, called the "ulcer of dentition," which localizes itself on the tongue after the appearance of the inferior incisors; such an ulcer presents a hard base and a yellowish discoloration, and may attain the size of a pea. It occurs mostly in children that have had whooping-cough, and it is evidently due to the pressure of the frenum against the incisors during the efforts of coughing. The coexistence of these two affections is so frequent that the diagnosis of whooping-cough can be made from the mere presence of this form of ulceration. It may, however, happen that such ulceration is the result of cough due to other causes. It disappears with the cessation of the cough.

**Inflammation of the Tongue (Glossitis).**—All inflammations of the tongue may at times become serious, owing to the rapid swelling of this organ, which may render deglutition impossible, and may even prevent the access of air to the respiratory tract. This accident is present not only in abscess of the muscular tissue of the tongue, but also in inflammations that begin on the surface of the organ and give rise to acute edema. This edema is attended with the formation of a liquid, serous in character, rich in pus-corpuscles. The inflammation of the lingual mucous membrane is similar to that of mucous membranes elsewhere. Catarrh of the stomach and febrile processes exert a secondary influence upon the tongue, and are sufficient to establish a local diagnosis. On the other hand, glossitis accompanies mercurial stomatitis. The mild forms of this condition can be recognized by the peculiar aspect presented by the tongue. The organ, whose mucous membrane is swollen and softened, presents, wherever it is in contact with the teeth, certain small depressions, forming, as it were, a mold wherein the corresponding portions of the dental arch would fit. On the projecting portions separating the depressions are gray deposits. If the use of mercury is not stopped presently, these ulcerations enlarge more and more, resulting in gangrene of the mucous tissue and considerable destruction of the tongue, and extensive adhesions may result. These consequences are not at all peculiar to mercurial stomatitis, but stomatitis due to other causes—for instance, ulceration resulting from the protrusion of the wisdom-teeth—produces a tumefaction of the tongue, with small ulcerations on the border of the organ. Burns of the buccal cavity, either by hot food or by concentrated acids, also cause inflammation of the epithelial layer of the tongue, resulting in large exfoliations. The treatment of this form of glossitis consists in the suppression of the cause and the use of disinfectant gargles. For mercurial stomatitis potassium chlorate is the best remedy.

Diphtheria may also develop upon the tongue, but always secondarily to infection of the neighboring structures.

We must not forget the special inflammations invading more especially the surface of the tongue and producing rapid tumefaction of the organ, resulting from traumatic lesions of an infectious nature, as the sting of a bee or of a wasp; the bite of a snake also would produce promptly mortal swelling. The development of malignant pustule on the tongue has been attended with a rapidly fatal extension of the infection.

Glossitis sometimes appears in the course of infectious diseases—for example, erysipelas, typhoid fever, scarlet fever, and small-pox. A localized abscess may form within the tongue in consequence of a slight traumatism, such as a wound from a fish-bone, from a blade of grass, or from a splinter of wood. Such abscesses are not easily detected at first, however, although the tongue may have become swollen to a considerable size; they result in deep glossitis and gradually diffuse abscess of the tongue. Curiously enough, diffuse abscess of the tongue may occur in an epidemic form. Deep glossitis sets in with intense fever and violent pains at the level of the tongue, radiating toward the ears and the hyoid bone. The swelling may develop so rap-

idly that at the end of a few hours the tongue fills the mouth, saliva escapes, deglutition is impossible, and asphyxia threatens. The diffuse tumefaction may diminish gradually, and an abscess may form about the middle or the side of the tongue. In other cases an abscess forms in neighboring structures, with penetration of the pus into the muscular interstices. The spontaneous rupture of such abscesses is sometimes followed by a fistula.

When the surface of the tongue has desquamated, the local use of tincture of iodin has proved useful in preventing further progress of the condition. It is found that this course is insufficient in tumefaction and rapid march, such as is observed in gangrenous glossitis, and also in the edematous conditions already spoken of. It has often been necessary to practise tracheotomy to save the life of the patient under these conditions; when the symptoms are less urgent deep injection of a two per cent. solution of carbolic acid may be used to abort the abscess.

**Thrush** existing upon the tongue is to be treated in the same way as when existing on the cheek and lips.

**Ichthyosis**, also called "buccal psoriasis," presents a condition analogous to the disease of the same name affecting the skin. It exists mainly among males, and is relatively frequent among syphilitics, especially among smokers. The disease is characterized by the appearance of white spots, somewhat elevated, round, irregular, serpiginous, and of varying size. These exist mostly on the tongue, but may also be present on the internal surface of the lips and the cheeks. Their appearance is preceded by a period in which the parts lose their villous structure; milky spots form next, and also small hard desquamations; when these are removed an ulcerative surface is revealed.

From the histologic standpoint the process is an inflammatory one of the mucous membrane, starting with a proliferation of cells, and forming finally a sclerosis; the epithelial layer becomes very much thickened, and the superficial layer of the epithelium forms the white spots described. At the same time this process attacks the deeper structures of the tongue, destroying the muscles and nerves and resulting in the formation of a scar. The condition is chronic and unyielding to treatment, and predisposes to the subsequent development of carcinoma. Patients thus affected should be advised to cease smoking altogether. The tendency to a cure is but slight. Cleanliness and the use of mild gargles, together with the removal of such spots as can easily be reached, form the only therapeutic measures at our command.

**Syphilis** presents itself on the tongue sometimes as a chancre at the tip of the organ, sometimes as secondary ulceration of a lardaceous appearance, and finally as a psoriasis with a tendency to ulceration. In the last case a differential diagnosis from simple psoriasis becomes very difficult. Generally, syphilitic ulcerations of the tongue exist around the edges of the organ; especially the secondary forms result in papillary hypertrophy. True condylomata also exist upon the tongue, together with condylomata elsewhere about the mouth. The tongue may also be the seat of a syphilitic gumma resembling a neoplasm, and sometimes it is almost impossible to make a dif-

ferential diagnosis between a gumma of the tongue, a cold abscess, a cyst, and carcinoma. Gummata appear in the form of tumors that grow slowly until they reach about the size of a pigeon's egg. They occur in the muscular structure of the tongue, preferably on the dorsal surface, sometimes also at the edges of the organ, and they undergo alterations characteristic of this form of pathologic process. In the absence of a history of syphilis gummata may be mistaken for carcinoma that begins as a nodosity, or for a chronic abscess, as already intimated. As soon as a gumma is opened it becomes possible to differentiate between the ulceration that results and carcinoma. When, however, many nodosities develop at the same time, the possibility of carcinoma is much more plausible. In doubtful cases small fragments of the tumors can be examined under the microscope; often also potassium iodid is the only means at our command to remove all doubts. Very soon the formation, if it be a gumma, disappears, and with it all doubt as to its character. However, it has often been observed that true gummata of the tongue become transformed into carcinomata. The diagnosis of tuberculous affections of the tongue is often attended with much difficulty. Tuberculous ulceration of the tongue is rarely observed in the form of nodes, but the process rather begins in the mucous membrane, which it soon softens and ulcerates; often also it is a small node of mucous membrane, mostly about the edges of the tongue, that starts the ulcerating process. Sometimes the affection will undergo spontaneous cure, but in the majority of cases it tends toward ulceration. The ulceration is superficial, with a hard base, and uneven; there are depressions of the epithelial layer, presenting microscopic tuberculous nodules (rarely visible to the naked eye) and covered with but scanty granulations; the edges are generally loose and free from sensibility. The ingestion of food or drink induces violent pain, and the patient loses flesh. An important fact is that tuberculosis of the tongue develops in those already affected with pulmonary tuberculosis.

When a person is attacked by tuberculosis of the tongue, the diagnosis is, as a rule, easy. There are, however, a number of ulcerative conditions of the tongue due to tuberculosis that have arisen without tuberculous affection in any other portion of the body, or long before the appearance of the symptoms elsewhere; it is in these cases especially that the differential diagnosis between tuberculous ulceration, simple ulcer, syphilitic ulcer, and carcinoma presents difficulties, and microscopic examination of small fragments of the ulcer can alone establish the differentiation. The diagnosis is of value mostly from the standpoint of prognosis. When suffering from inability to take sufficient food becomes so great that radical interference becomes imperative, this will consist in the removal of the ulcerated portion of the tongue, followed immediately by suture of the edges of the wound; or the scraping of the ulceration with a sharp curet; or else the destruction of the disease-process by means of the thermo-cautery or the galvano-cautery. Inasmuch as such patients are already greatly reduced, care should be exercised not to cause more hemorrhage than is absolutely necessary. Finally, *lupus* may be present

on the tongue at the same time as it exists on the palate, the gums, or the internal surfaces of the cheeks. The diagnosis is always easy, although at times it may be necessary to make the differentiation from syphilis.

**Lymphangioma** is the most common of the tumors that cause enlargement of the tongue. This is really the condition that in the majority of instances is knows as "congenital macroglossia." Most of the cases present a disturbance of the lymphatics of the tongue, a stasis of lymph, due probably to some obstacle to the flow of the fluid by obliteration of the lymphatic vessels, and other pathologic processes. There is, besides, a true hypertrophy of the tongue, consisting in proliferation of the fibrous tissue, and which may develop in the sequence of a series of inflammatory attacks. The symptoms vary according to the increase of the size of the tongue, which may be limited or diffuse. As a result of the swelling of the tongue and the pressure upon the teeth by this organ these have a tendency to assume the horizontal direction, gradually loosening and finally dropping out. The palate also suffers a deformity from the pressure exercised by the tongue, becoming flattened out. The surface of the tongue becomes irregular, warty, and fissured. Most of the cases are congenital. A morbid process resembling erysipelas, arising sometimes spontaneously, at other times from traumatic lesions, is supposed to account for acquired macroglossia.

Compression has been attempted to diminish the size of the tongue, but very few good results have been obtained, inasmuch as the arrangement of the parts does not admit of great compression. Large incisions have been made in the tongue in order to reduce its edematous condition, but these are followed by intense hemorrhage which may necessitate the ligation of the larger blood-vessels of the neck. The thermo-cautery and the galvano-cautery have also been resorted to in order to transform the edematous mass into cicatricial tissue.

**Cysts of the Tongue.**—The most frequent cysts of the tongue are those of the mucous glands and hydatid cysts. Mucous cysts develop in those parts of the tongue most plentifully supplied with mucous glands—that is, the tip, the edges, and the base of the organ. They result from obliteration of the respective ducts. These tumors never reach any considerable size, being about the size of a pea; they are hard and they seldom fluctuate. The hydatid cysts closely resemble mucous cysts in volume and form, but the former are seated more deeply in the muscular mass of the tongue. If exploratory puncture is resorted to (it is almost essential for a diagnosis), the fluid removed is mucous in character if from a mucous cyst, clear if from an hydatid cyst. An incision into the latter reveals the presence of the echinococcus. Further, the possibility of an abscess, and also of carcinoma, should likewise be thought of. There are also on record cases of dermoid cysts of the tongue, which are always on the middle line. They must be treated by complete extirpation.

**Carcinoma of the Tongue.**—The most frequent neoplasm of the tongue is carcinoma. It affects men rather than women, probably from the irritation of the tongue due to excessive smoking. A small increase in the papillæ of

the tongue, together with a certain local uneasiness, is usually the first symptom. Hypertrophy soon results, then desquamation of the epithelium and progressive ulceration. Epithelial vegetations surround the ulcerations, followed soon by metastasis to the neighboring glands. The pain becomes very acute and radiates toward the ear. It is due to infiltration of the lingual nerve by the carcinomatous mass, and resembles facial neuralgia. The tongue becomes fixed to such an extent as to interfere with mastication, deglutition, and speech; as a result the buccal cavity ceases to be cleansed as it should be, and there is putrefaction of the alimentary products, followed by a foul odor. Cachexia soon develops, and with the added difficulty of respiration, the extension of the morbid process to the trachea and the larynx, and the danger of hemorrhage, the tongue becomes the most dreaded portion of the body for the development of carcinoma.

The prognosis is extremely grave. Nothing short of complete extirpation of the tongue offers any hope of a respite; but even then, metastasis having invariably taken place, the disease is almost certain to return.

Many operations for the removal of the tongue have been devised, with or without resection of the inferior maxilla, for a full description of which reference is made to the appropriate works on surgery.

Division of the lingual nerve has been practised to secure relief from the violent pain that accompanies carcinoma of the tongue and in incurable cases the lingual artery has been ligated to hinder the development of the neoplasm.

### Diseases of the Tonsils and of the Adjacent Pharynx.

That this region is often the seat of inflammatory processes is not astonishing when one recalls the numberless causes of irritation to which it is exposed from the passage of food and air, with all their impurities. Another condition favoring the development of such processes is the anatomic structure of the parts, characterized by an abundance of glands and lymphatics. Thus, between the pillars and the veil of the palate on each side is the tonsil, presenting lobules separated by depressions. The thickened mucous membrane consists partly of fibrous tissue and partly of adenoid tissue, the pavement-epithelium being very thin. The vascular layer and the mucous membrane are infiltrated with lymphatic corpuscles, while bundles of connective tissue pass from the submucous layer, and there are present a certain number of glands which are analogous to Peyer's patches in the intestines.

The structure of the tonsil affords, as it were, an inviting basis for the different causes of inflammation. It is there that the poison of diphtheria generally lodges before extending to neighboring parts. A general inflammatory condition of the pharynx and tonsils can often be noticed as a result of exposure to cold or from other chemic, physical, or specific irritations. Catarrhal angina, or catarrhal croup, sometimes exists alone and sometimes accompanies a coryza. Inflammation of the trachea and bronchi manifests itself by the general swelling and inflammation of the isthmus of the glottis, and also by difficulty in deglutition and phonation. The glands and follicles of the

mucous membrane, especially on the posterior aspect of the pharynx, jut out and form small nodosities. When the acute symptoms are about to subside, an abundant secretion of mucus takes place from the posterior part of the pharynx, and a swelling shows itself, resulting from hypertrophy of the tissue that surrounds the glands and follicles.

Primary erysipelas is quite rare in the region of the tonsils. It may result from an extension of the disease from the nose and mouth to the pharynx. The symptoms are the same as those of catarrhal croup. In addition there is considerable edema of the submucous tissue, especially about the uvula, which sometimes attains extraordinary size. The inflammation may extend to the aryteno-epiglottic folds and result in asphyxia.

The mucous membrane of the tonsils when submitted to pathologic influences presents a papillary aspect. The depressions or crypts extend deeply into the organ. In acute inflammation deposits of yellowish masses may often be observed in the interior of these crypts. The surface of the tonsils is sometimes covered over with a delicate layer of desquamating epithelial cells. The inflammatory process extends for three or four days in a typical way, and is accompanied by febrile symptoms, often quite intense, together with pains in the back and the limbs. Often both tonsils are affected at the same time. This form of inflammation has been called "tonsillar herpes" or "herpetic tonsillitis," also "follicular tonsillitis." Many authors make a distinction between this form of tonsillitis and diphtheria of the tonsil, but not always justly, for in both instances the bacilli of Loeffler may be found in the exudate. The tonsils are often the center whence diphtheria spreads. This affection may exist in a form more or less benign, involving only the superficial layers of the mucous membrane and accompanied by moderate fever. In other cases it is attended with deep destruction of the mucous membrane, as well as of the submucous tissue, and the symptoms of septic fever appear.

The etiologic factor is without doubt the bacillus of Loeffler, which locates itself in the glandular structure and by its development causes a local irritation of the tissues that results in a proliferation of the epithelial layers, which soon undergo degeneration; or else the bacilli invade the deeper structures of the mucous membrane and there proliferate, developing small cystic cavities accompanied by interstitial hemorrhage. The very rapid development of the germ itself brings on ulceration of the tissue thus invaded. At the same time the lymphatic vessels absorb the poisons generated and transport them to the neighboring lymphatic glands. The nephritis that often accompanies diphtheria is due to these poisons; so too is the paralysis that often follows.

As already indicated, diphtheria often presents different degrees of intensity. Starting from the tonsils, it may extend as membranous croup to the pillars and to the uvula; it also propagates itself to the posterior cavity of the nose and to the nasal cavity itself, where it finds a most favorable soil for putrid decomposition and determines the symptoms of septic fever. The posterior part of the pharynx is less often attacked, and still more rarely the esophagus. Diphtheria often invades the trachea and bronchi, but rarely before the third

day, and sometimes as late as the eighth or ninth day. Instead of the different layers of which we have spoken, often there is to be seen but a membranous deposit which is easily removed; while at other times there is found a thick, dense, resisting layer that cannot be removed without causing hemorrhage. In such cases the surface thus exposed becomes putrid, and septic fever brings on a fatal termination.

Of the many different types of pharyngitis mentioned, the catarrhal form and the erysipelatous form need but little except expectant treatment. In catarrhal angina all irritations of the throat should be avoided, and gargles prescribed, such as a solution of salicylic acid or potassium chlorate, which can be employed also in the form of a spray. Cold cloths about the neck will be found of value. If the symptoms do not subside in a short while, we may paint the mucous membrane with a slight astringent or slightly caustic solution. Typical follicular tonsillitis tends toward a cure without treatment, but the patient should always be isolated if diphtheria is suspected —a precaution that must invariably be taken, to prevent contagion.

The false membrane should be removed by means of a brush or a cotton tampon; the parts should then be sprayed with a solution of acid mercuric chlorid[1] 1 : 2000; likewise the nasal cavities should be injected with the same solution. The patient should be watched carefully, especially as to extension to the larynx, and when this takes place the parents should be consulted immediately as to the advisability of tracheotomy.

Certain children of the scrofulous diathesis develop severe tonsillitis on the slightest exposure to cold. Inflammation will take place and disappear without leaving any special trace; at other times a few superficial abscesses will form and will spread to the neighboring parts and follicles, especially on the posterior portion of the veil of the palate. Inflammatory processes may also invade the larynx and produce the croupous cough so well known. The disease itself has no gravity, and its worst termination is the formation of superficial abscesses.

The treatment consists in placing cold wet cloths about the neck. If the tumefaction of the tonsils persist, the throat may be sprayed with a weak solution of silver nitrate. After repeated attacks, however, it often happens that permanent enlargement of the tonsil takes place.

The well-known affection called "hypertrophy of the tonsils" is found to be the result of a series of inflammatory processes such as have just been detailed. After each attack the tonsils remain somewhat larger and their surface uneven. Deep depressions are formed at the spot where abscesses had existed, and eventually the two tonsils bulge out into the isthmus of the glottis as two irregularly round tumors, one generally larger than the other. These tumors may sometimes reach the size of a hen's egg. The marked depressions on the surface lead to a cul-de-sac of the mucous membrane between the follicles of the tonsil. Mucus accumulates in these depressions, and caseous masses, as well as calcified bodies, may be found located therein. As this hypertrophy

[1] Tartaric acid, 5 grams; mercuric chlorid, 1 gram; water, q. s. ad 1000 grams.

of the tonsils is due, as has already been stated, to repeated attacks of tonsillitis, it has been found following diphtheria and the local inflammation of scarlet fever and typhoid fever; it may also arise without any preceding inflammation. It is, above all, a disease of childhood, and it has even been found during the first year of life.

A prominent symptom of hypertrophy of the tonsils is a difficulty in phonation, particularly of the consonants *l* and *r*, while the voice rises to a higher pitch. This fact should be remembered, for it may happen that the removal of the tonsils will considerably alter the voice of singers and public speakers.

Troubles of respiration have an especial importance in children. Hypertrophy of the tonsils may be suspected in a child whenever it suddenly starts snoring during sleep, while the breathing presents a type of great distress, especially when lying on the back. Gradually the respiratory movements become shorter and shorter; the accessory muscles of respiration are called into play, at each inspiration the suprasternal fossa and the epigastrium are depressed; the lips become cyanosed, the skin covered with perspiration, and the respirations become shorter and shorter to almost complete cessation, and it would seem as though a valve were progressively preventing the entrance of air. When these phenomena have reached their highest pitch the child turns ordinarily on one side, and, the obstruction being removed, breathing becomes normal, when a noise is produced by the larynx as though a valve had suddenly opened. These phenomena appear during the night and in the dorsal decubitus, because the tonsils, when greatly swollen, close down in connection with the veil of the palate and the tongue. The nasal cavity is thus also closed, and the inspired air penetrates into the mouth and brings the two tonsils more and more closely together until the occlusion becomes complete, as if by a valve. This occlusion ceases suddenly when the child changes its position and modifies the mechanical conditions of the parts. In very small children this labored respiration sometimes brings about a deformity of the thorax characterized by bulging of the sternum. It has been maintained that this deformity can be found in half of all the cases of hypertrophy of the tonsils and in two-thirds of the children affected by this disease, and that the deformity always disappears after tonsillotomy. Breathing through the nose becomes impossible, and, inasmuch as the patient can breathe only through the mouth, his appearance becomes quite peculiar. Hearing is affected, owing to the extension of the inflammation to the opening of the Eustachian tube and to the pressure of the tonsil upon this orifice. These facts certainly emphasize the necessity of removing the tonsils when they are greatly hypertrophied.

The operation of tonsillotomy is neither difficult nor painful. The parts should be anesthetized thoroughly by the application of a 5 per cent. solution of cocain; by means of a tonsillotome the operation is rendered painless. Tonsillotomy is also performed by securing the tonsil with a hook and using a probe-pointed curved bistoury. The chief danger from the operation is hemorrhage. Though the internal carotid is not far from the tonsil, and is separated from it by a capsule of connective tissue and the constrictors of the

pharynx, a lesion of this vessel would certainly prove a grave misfortune. There is no necessity of removing the gland completely, nor of tearing the tonsil violently from its nest by means of a hook, nor of introducing a bistoury behind this organ at the risk of plunging it into a large blood-vessel. If the operation is well performed and a vessel of some size be wounded, this can only be a branch of the superior palatine artery, which can be controlled by direct digital compression of the carotid, by the ligature of the vessel, or by a suture applied at the spot from which the blood flows. When the hemorrhage is very profuse, it may be due to a condition of hemophilia, as is sometimes, unfortunately, the case.

Subsequent to the removal of the tonsil a slightly astringent solution of tannic acid, ferric chlorid, or potassium chlorid will immediately check the slight hemorrhage that may occur.

In speaking of ulceration of the pharynx, it must be repeated that catarrhal ulceration is very rare, while syphilitic ulceration is frequent. The mucous membrane of the pharynx is also found affected with lupus. Tuberculous ulceration is not rare on the tonsils and the posterior portion of the larynx—a fact that is not astonishing when we remember how rich these organs are in lymphatic tissue. The tuberculous nature of the ulceration is easily recognized by its eroded base, by the edges being dissected and free, by the bluish coloration of the mucous membrane, and also by the existence of small nodules here and there on the ulcer and about its neighborhood. In other cases it is not easy to make a positive differential diagnosis between syphilitic and tuberculous ulceration, especially when the process is extensive and situated on the posterior portion of the larynx; often the only course is the administration of potassium iodid, which will speedily cause syphilitic ulceration to disappear. In the tuberculous ulceration we have no means at our command but curetting the diseased area and applying iodoform or the actual cautery; and thorough hygienic measures should in every case be recommended.

Phlegmonous tonsillitis, or abscess of the tonsil, may accompany diphtheria, but it occurs also as an independent disease, affecting one and sometimes both tonsils, and having a tendency to recurrence. The symptoms of phlegmonous tonsillitis seem to demonstrate that the disease exists in the peritonsillar connective tissue. Only thus can be explained the general tumefaction of the parts and the edema of the mucous membrane that extends to the veil of the palate and along the posterior pillars of the pharynx. While the abscess develops upon or outside of the tonsil, or else along the posterior portion of the organ itself, various conditions of swelling are found in the different parts. The abscess generally develops on the anterior portion of the tonsil, and finally invades the anterior pillar of the pharynx; more rarely is the posterior pillar affected, when the disease may burrow its way toward the vertebral column along the superior constrictor muscle of the pharynx, forming a retro-pharyngeal abscess laterally in the neighborhood of the carotid. We should make a guarded prognosis, for destruction of the

coats of this vessel has resulted in mortal hemorrhage which nothing but ligature of the carotid could have arrested. This accident has been observed after incision of the abscess, and it also occurs spontaneously, not only in tuberculous and syphilitic cases, but also in otherwise absolutely healthy individuals. Sometimes, by the abscess becoming pulsatile, we are enabled to diagnosticate perforation of a blood-vessel. In any case there is no hope when such perforation has taken place, except through ligature of the carotid.

The symptoms of phlegmonous tonsillitis are extremely painful. When the disease is extensive the patient presents high fever, also severe pain on a level with the tonsil and the corresponding portion of the pharynx, radiating toward the head, and increasing so much with the movements of the palate and the pharynx that he can neither talk nor swallow anything but liquids in small quantities. Speech is embarrassed, as though the patient held a large foreign body in the posterior portion of the mouth. The jaws can be but slightly opened, a foul odor comes from the mouth as a result of incomplete cleansing of that cavity, and the mucous membrane soon becomes detached. Intense headache, due to compression of the larger blood-vessels, and an agonizing sense of asphyxia exist, especially at night while in the dorsal decubitus.

All the gargles that have been advocated are useless. The only means of lessening the development of the disease is the application of an ice-bag to the neck. The object should be to free the patient as soon as possible from his sufferings by an incision. Still, this should never be attempted until the presence of pus has been localized absolutely. These incisions are very painful, and the patient will surely not submit to a second one should the first fail to afford relief. The detection of fluctuation should always determine the spot to be incised, and it is especially at the level of the anterior pillar that the hard mass of the abscess is likely to point; this will prove to be the spot of greatest sensitiveness. When this is determined, the left forefinger being placed upon the tongue in order to protect it, a pointed knife or tenotome is inserted transversely to the veil of the palate to the extent of one or two centimeters; a free incision is generally required to ensure a full evacuation of the pus. The greatest caution must be used not to wound the internal carotid artery. To avoid this accident the knife should be directed rather inwardly and should be drawn backward across the posterior pillar.

Although tumors of the tonsils are not frequent, fibromata and sarcomata, as well as carcinomata, have been found in that locality. Carcinomata are, however, the most frequent of all tumors of the tonsils, and are consequently attended with an unfavorable prognosis. It is rare that carcinoma is of primary origin here, but it occurs generally from metastasis, the original growth existing on the veil of the palate or on the mucous membrane of the mouth, the cheeks, etc.

## Diseases of the Pharynx and the Esophagus.

Dysphagia has long been recognized as indicative of functional troubles in the neighborhood of the pharynx and the esophagus; but dysphagia is not only met with in local affections of the apparatus of deglutition: it may also depend on disease of neighboring structures and of the central organ of the nervous system. Phenomena of compression are often produced by tumors developing around the esophagus and in the deeper structures of the neck; morbid conditions of the central nervous system may also give rise to dysphagia, either directly, or indirectly by reflex action. Obstruction to deglutition may further be due to morbid processes affecting the nerves and muscles constituting the apparatus of deglutition, or to mechanical causes within the pharynx and the esophagus. Mechanical causes result from a stricture or a solution of continuity at some point. In the pharynx especially it is necessary that a certain amount of freedom should exist, in order that deglutition may be performed without difficulty. When the muscles of deglutition contract, the respiratory passages must be closed sufficiently to prevent the entrance of food into the nose or the trachea. The occlusion may be imperfect, as a result either of muscular paralysis or of loss of substance from the palate or the epiglottis.

Functional troubles in the motor apparatus may result in partial or total paralysis; they occur in febrile processes, in the moments preceding the agony of death, or in disease of the central nervous system. The phenomena will vary according to the degree of paralysis. In total paralysis there is absolute impossibility of allowing food to enter the esophagus. The food remains in the mouth and in the pharynx, and, according to the laws of gravitation and to the position of the patient, will find its way into the larynx or into the nasal cavity, whence it must be withdrawn to prevent asphyxia. Such a paralysis is comparatively rare in diphtheria. When, however, it occurs, patients must be fed through the esophageal tube.

When stricture occurs lower down in the esophagus, deglutition may be possible, but after a while regurgitation takes place and gives rise to a sort of rumination.

The diagnosis should be made by touch and by the examination of the pharynx by direct or reflected light, in conjunction with exploration of the pharynx and the esophagus by means of the sound.

**Lesions of the Pharynx and the Esophagus due to Chemic Caustics, Acids, or Alkalies.**—These substances are concentrated chemicals, generally acids, and are taken either by accident or with suicidal intent. The effects vary greatly according to the concentration of the chemic substance introduced. When a mineral acid has been swallowed in large quantity, total destruction of the pharynx and esophagus may result, and death may follow in a short time. If the acid is diluted, and only exerts a corrosive influence on the mucous membranes, blebs are formed, resulting in ulcerated surfaces afterward. It sometimes happens, however, that the esophagus is left intact; the mucus

on the surface has been coagulated and is shed off. Very often the lesion exists further down, and causes frequent hemoptysis and violent pains along the esophagus and in the stomach.

The phenomena are collapse, retention of urine, intense thirst, and difficulty in deglutition and in phonation.

The treatment consists in evacuating as soon as possible the liquid introduced into the stomach, and the neutralization of its effects. The stomach-pump should be resorted to immediately. If the substance be an acid, it will be neutralized by chalk or lime or potassium carbonate; if an alkali, the patient should be given one of the vegetable acids. The subsequent treatment is, above all, surgical, and should have in view the cure of the chronic ulceration that may result. As soon as the phenomena of irritation have disappeared the esophageal tube must be often resorted to for feeding the patient, or the sound for preventing the formation of a stricture.

**Inflammatory processes in the esophagus** have importance for the physician only in that they may result in a stricture of this organ. Acute and chronic catarrh follows irritation of the esophagus, such as may be caused by the swallowing of very hot food or of foreign bodies, and in chronic cases the irritation produced by alcohol. Catarrhal conditions of the esophagus assume the desquamative form; secretion is very scanty, the longitudinal folds are swollen, and the mucous membrane presents erosions and ulcerations. It was formerly admitted that chronic catarrhs could result in hypertrophy of the muscular coat, with infiltration of the submucous connective tissue, and the thickening that would follow was supposed to cause a stricture. Later researches have shown that this is not the case, but that an actual new-formation underlies such a condition. The catarrh is simply a predisposing cause for such vegetations as polypi or hypertrophy of the muscular tunic and a tendency toward a diffuse edema.

Follicular esophagitis is an independent condition. It is sometimes observed in infectious diseases, and is characterized by swelling and ulceration of the follicular glands of the esophagus. These ulcerations are not very deep and are not followed by cicatricial contraction. Diphtheria usually remains limited to the pharynx, and in the few cases in which it spreads to the esophagus it does not of itself give rise to secondary stricture of this tube. On the other hand, thrush sometimes induces complete desquamation of the esophagus, and children have often been known to die from a stricture resulting from this condition.

There is a disease known as "phlegmonous esophagitis," analogous to the affection of the similar name in the stomach. Here a purulent collection in the submucous connective tissue raises the mucous membrane, and in the acute stage may even cause stenosis of this tube; later it perforates the mucous membrane at different points and may also find its way to the outside. In this way several abscesses and sinuses are formed around the esophagus, and finally may open in the neighboring trachea.

Phlegmonous esophagitis may be caused by a foreign body or by an access of pus from a periesophageal abscess into the submucous cellular tissue.

The symptoms of stricture of the esophagus are variable, according to the degree of the contraction. In a general way they consist in difficulty in swallowing both of solids and of liquids. Sometimes hard substances are swallowed with less difficulty than soft, contrary to what might be expected. In extreme cases the patient can swallow but little liquid, and that with much difficulty. Pain is then felt immediately above the stricture. When this is at a high level, food is no sooner introduced than it is rejected. The only positive mode of ascertaining the size and the locality of the stricture is by the use of the esophageal sound. The tongue is pushed back in the mouth, and an olive-pointed sound is slid over the base of the tongue into the esophagus, the head being held back. When strictures are not due to accountable cause in a patient over forty years of age, a diagnosis of carcinoma becomes very probable.

The result of the persistence of a stricture of the esophagus is inanition; if due to carcinoma there results, directly or indirectly, poisoning of the system.

Gradual dilatation, forced dilatation, and esophagotomy are the operations resorted to for the relief of stricture of the esophagus. When these operations cannot be undertaken, the establishment of a gastric fistula, or gastrostomy, remains the only means at our command for prolonging life.

**Foreign Bodies in the Pharynx and the Esophagus.**—The phenomena caused by the arrest of foreign bodies in the pharynx and the esophagus depend on whether the foreign bodies provoke a stricture or make a wound. Of course, these two phenomena are not always separated. A coin or a pebble will obstruct the lumen of the esophagus as well as cause a wound of the mucous membrane. There are some bodies, however, that simply block the esophagus, and others that produce a wound. Certain bodies lodge in the esophagus, and immediately the violent efforts to reject them by coughing increases their fixation, especially if they be pointed, such as a fish-bone or a hook. There may thus result complete obstruction of the esophagus, of a portion of the larynx, and of the trachea, with asphyxia. There is extreme depression, a look of despair, and when the foreign body is removed, all the symptoms immediately disappear. If, on the contrary, the body is neither swallowed nor rejected, there result quite typical phenomena of stricture. Not a single drop of fluid can reach the stomach, and symptoms of asphyxia follow. Should the foreign body be not removed, ulceration may take place, and may possibly involve the bloodvessels of the neighborhood, especially the carotid, the inferior thyroid, the subclavian, and the superior vena cava. In such a case the blood flows directly into the esophagus and is vomited. As a means for the relief of this condition the administration of chloroform has been resorted to, when, owing to its relaxing effect on the muscles, it sometimes occurs that the foreign body is loosened and is either vomited or gravitates into the stomach. Should this means fail, an attempt should be made

to push the foreign body into the stomach or to extract it through the mouth. The esophageal sound may be used to effect the former object. Instruments for removing a foreign body through the mouth act in a different way than does the sound, and are fully described in works on surgery. Should none of these means succeed, esophagotomy should be resorted to. This operation has of late years proved quite successful; and, indeed, rather than groping one's way in the dark for the removal of a foreign body, it may be wise to resort to the operation at first, inasmuch as it is attended with comparatively little risk, and enables the surgeon to have direct access to the foreign body.

# DISEASES OF THE STOMACH; DUODENAL ULCER.

By CHARLES G. STOCKTON.

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There are two reasons why the functional disorders of the stomach should receive primary consideration: first, because of their great frequency; second, because they not rarely constitute the early history in the pathology of the structural diseases of the stomach. Long-continued functional perversion leads to change in structure, and it is wiser to forestall the natural march of pathology by applying relief to the functional disturbances before the appearance of those changes that may be incurable.

These disorders are generally described as "gastric neuroses"—and these, indeed, they often are; but frequently the trouble is merely a gastric symptom of a functional disturbance that, in other individuals, may exhibit itself in muscular weakness, headache, menstrual disturbances, etc. A neurosis should be regarded more in the light of a distinct affection. It is, for instance, proper to regard merycism and essential gastralgia as examples of gastric neuroses; but tardiness in the absorption of the stomach-contents, nausea, flatulence, and "gastric unrest" are generally to be regarded as symptoms of nervous depression or nervous excitement referred to the stomach, although it is true that they may arise from other causes.

It is convenient to divide these functional disturbances into—first, those that are attended with gastric irritation, and second, those that are attended with gastric depression; but, while convenient, this division is often unsatisfactory, as there may be in the same case irritation on the one hand and depression on the other. As a matter of fact it is necessary to determine in each individual case as to whether sedative or stimulating treatment is needed, and it will not infrequently be found that while so far as sensation or secretion is concerned soothing measures are required, the motion and the absorption require stimulation.

The functional disorders may be divided into—1. Disturbances of secretion; 2. Disturbances of motion; 3. Disturbances of absorption; 4. Disturbances of sensation. Although none of these is commonly observed alone, it is in the interest of simplicity to regard them as separate conditions. It is occasionally observed that one alone is discoverable, and at times a given disturbance predominates for a certain period, to be replaced later by another.

**Etiology.**—*Overtaxing.*—Functional disorders of the stomach may ensue from long-continued overtaxing of the organ by over-eating, by unsuitable food,

by improper mastication, and by too liberal potations during meals. When resulting from over-eating this overtaxing is commonly seen in those who have changed from an active, open-air life to a sedentary and confined existence, without adequate modifications of the dietary. When resulting from unsuitable foods, the trouble will often be found in the cooking. While it is universally acknowledged that over-indulgence in sweets, pastries, and highly seasoned foods becomes a tax upon digestion, observation teaches that foods that should be wholesome but are rendered indigestible, irritating, and almost poisonous by improper preparation, are far more often the causes of the digestive failure. The proportion of families in which good cooking is never seen is astonishingly large, and ignorance upon the subject, both in and out of the profession, is a serious obstacle in the way of prophylaxis and therapeutics. Imperfect teeth and tender gums are responsible for much poor mastication. The habit of bolting the food, acquired in childhood, follows many people through life, and its continuance is encouraged by the exigencies of business life, whereby too short a time is allowed for eating and rest. As the salivary glands are unable to keep pace with the act of deglutition, the custom of washing down the food and thus denying the stomach the physiologic assistance of free salivation facilitates the evil habit. It should be added that irregularity in the time of taking meals is a factor in overtaxing the stomach. While it is true that some individuals require frequent and others infrequent meals, there should be preserved a proper order in the matter; and, omitting this, there is easily established a disturbance in gastric chemistry that is not compatible with comfortable digestion.

*Fasting.*—When the stomach receives for a prolonged period less food than it demands there arises disordered digestion, not alone from anemia, or from debility, but from derangement of the gastric functions; and these disturbances may continue indefinitely after removal of the cause.

*General Exhaustion.*—The digestion fails, with the decline in other functions, in the exhaustion accompanying or following acute or chronic diseases, over-work, loss of sleep, or brain-tire. Of course this partly depends upon an imperfect blood-supply and diminished activity in general, but doubtless feeble innervation is a prominent factor in the matter. In such cases the appetite is often disproportionately keen, and overtaxing of the digestion is then likely to occur. Prudence in diet, when the energy is flagging, will often prevent a disordered digestion, which, once established, not only delays recovery but sometimes is itself very rebellious to treatment.

*Neurasthenia.*—In the troublesome complex of symptoms described as neurasthenia, irregularities in the behavior of the digestive apparatus are rarely wanting. Occasionally the digestion is good, and there may be present merely gastric paresthesia without marked difficulty in the solution and absorption of food. In other cases functional disturbances of every variety appear, and recovery from the neurasthenia is thereby rendered extremely difficult. It is more common to find the mixed symptoms in neurasthenia, and the therapeutist discovers then how much more difficult it is to successfully manage

such gastric states than those wherein, for instance, disturbances of sensation or of motion alone are present.

*Disease of the Central Nervous System.*—Vomiting has long been known to result from central nervous disease, but other gastric symptoms are also observed, although they attract less attention. Conspicuous as causes are cerebral hyperemia and anemia, general or local (embolism, arteritis deformans, etc.); chronic hydrocephalus; concussion; cerebellar, cerebral, and medullary growths; Ménière's disease, tabes dorsalis, and spinal pressure or irritation connected with Pott's disease and scoliosis. Sometimes in the incipiency of spinal caries marked gastric symptoms supervene and fail to disappear until extension and support are practised, when they rapidly subside.

*Hysteria.*—Perhaps there is no form of functional disorder of the stomach that may not be dependent upon hysteria. It is not always possible to say that such cases are purely hysterical. Doubtless hysteria results from stomach-diseases in not a few instances, so that one may not be able to say which preceded. It is necessary to recognize the hysteria, but no less necessary to appreciate the importance of gastric derangements that are distinct from the hysteria, although exaggerated by it.

*Degeneration of the Sympathetics.*—Gastric disturbances arise not alone as a result of degenerative changes in the gastric distribution of the vagus, as occurs in posterior spinal sclerosis. Degeneration in the plexus of Meissner and in Auerbach's plexus is also accompanied by persistent functional and sometimes structural disease. Unfortunately our knowledge of this subject is yet somewhat nebulous, but enough is ascertained to warrant the statement.

*Reflex Action.*—The great frequency with which reflex irritation is found to be the exciting cause of functional disturbance renders it most important that a careful search for the source of a possible reflex be made in every instance. Even when other causes are operative a reflex is likely to prove contributory, and, a functional disturbance once established, it is often impossible to remove it while the reflex continues. The real value of this truth does not seem to be appreciated, and nowhere do the reflex irritations manifest themselves so strikingly as in gastric disorders. In the search for the origin of the irritation, attention should be directed to the eyes, the naso-pharynx, the hysterical spine, the floating kidney, ureteritis, and diseases of the rectum; in the female, to the uterus and its appendages, and the vagina and clitoris; in the male, to the urethra and the prepuce. Of all these the most important is eye-strain. The defect may be one of refraction or of muscular balance, or both of these, and in neuropathic patients, in whom the nervous system has from long nagging become irritable, relief is not obtained until proper correction is made. Without eye-correction it is often possible to restore to the stomach comfortable digestion, but so long as the reflex continues the case is likely to relapse, particularly when the wear and tear of daily life make severe demands upon the organism. When the eye-strain is overcome, the improvement is likely to remain permanent and the gain in general health will enable the patient to escape his digestive trouble altogether.

*Toxemia.*—Without discernible changes in structure, serious functional disorders of the stomach are found to depend upon the various forms of toxemia. Probably the most frequent offender in this line is that complex state termed uremia and depending upon some form of nephritis or upon functional insufficiency of the kidneys. The physician is not likely to go astray as to the cause of the gastric disturbance in a well-marked case of nephritis, but renal insufficiency is often the unsuspected cause of serious stomach-trouble. But little light can be had on the matter save by repeated examination of "twenty-four hours'" specimens of urine. The study of a single specimen is not enough. The conclusion should be based upon the amount and character of urinary solids eliminated during the twenty-four hours. The state of the urine defined by Gouley as hyperlithuria, which is the expression of that condition of the fluids of the body generally, although perhaps improperly, understood by the term lithemia, should receive attention in the treatment of gastric disorders. The toxemia accompanying true gout, not that so-called "lithemic state" falsely conceived to be latent gout, but true podagra, whether acute or chronic, is occasionally the underlying fault in a stomach-attack. It is well known that in the debility accompanying secondary or tertiary syphilis the stomach, together with other organs, may fail. There is, however, a form of functional derangement, showing itself particularly in disturbances of sensation and secretion and appearing in individuals who have apparently been cured of syphilis, that, so far as I know, remains undescribed. In such patients there is no greater weakness than would be accounted for by the stomach-trouble. All of the symptoms are referred to the stomach, and often the patient would not be suspected of having had syphilis, as occasionally these symptoms appear when no evidence of syphilitic manifestations can be discovered. The real nature of the difficulty is revealed, however, by the fact that the symptoms will not abate under what is ordinarily enlightened and successful management, but improvement immediately follows the administration of mercury, iodin, and baths.

Tuberculosis is often introduced by functional gastric disorders. These probably result from toxemia, although they are found before any other evidence of tuberculous disease is discovered. Of course it is possible to suppose that gastric disease merely predisposes to an oncoming pulmonary tuberculosis, and the varied expressions of indigestion that precede tuberculosis would seem to add some weight to the argument. Still, the frequency of the gastric precursor would seem to be more than a coincidence, and one is inclined to believe that in certain cases it is the direct result of tuberculous infection already present. Malaria, diabetes, and other affections are frequently accompanied by gastric disturbance apparently dependent upon toxemia.

The stomach is often disturbed as a result of slow intoxication with various poisons—as, for instance, in chronic arsenical poisoning, which sometimes announces its presence first by intractable morning vomiting, without special evidences of indigestion, and sometimes by disturbances of secretion of an aggravated character. In this category belong those

derangements of the stomach that arise from the habitual use of tea, coffee, and tobacco.

In reviewing the general causes of functional gastric disorders one is impressed with the great frequency with which such disturbances apparently arise from irritation of the nervous system at a point remote from the stomach. When cases are carefully studied it is found that almost invariably such irritation is present and that improper diet and other forms of overtaxing of the digestion are but contributory factors. Therefore, in order to treat successfully the affections in question, the most careful attention must be directed to the general economy, with a view to relieving the cause.

**Hyperchlorhydria.**—When free hydrochloric acid is found in the gastric contents beyond the normal limit of 0.24 after a test-breakfast, or when it continues after the stomach is empty, hyperchlorhydria is said to exist. This occurs as a single fault of digestion, or it is associated with other chemic defects. Generally there coexist motor disturbances, as shown by the belching of gas, the regurgitation of acid fluid, and rarely by vomiting or by the too early emptying of the stomach onward. There are also usually present some forms of gastric distress, sometimes mere uneasiness, a sensation of burning in the epigastrium, a feeling that the food has not been digested, and occasionally positive pain, at times amounting to gastralgia. The disturbed sensations are most often experienced an hour or two after meals, and are aggravated by the taking of sour wines, acid fruits, particularly strawberries, fruit-juices, and all acid and most stimulating substances. It is at this time also that the other symptoms are most evident, and the belching of gas accompanies the uneasiness in nearly every case.

Albuminoid foods stimulate the secretion of hydrochloric acid, but at the same time they are most easily digested and absorbed. Starchy and saccharine foods are usually slow of digestion, and remain behind after the albuminoids have disappeared, and continue the irritation by their mere presence, as well as by the production of organic acids as a result of fermentation.

There appears to exist a natural antagonism between the lactic acid normally present in early gastric digestion and the hydrochloric acid that supersedes it. When this relation is disturbed—that is, when the hydrochloric acid appears too early or the lactic acid continues too late in the process of gastric digestion—then derangement of digestion and consequent symptoms occur. It is impracticable to treat satisfactorily hyperchlorhydria without occasional examination of the stomach-contents. Sometimes a single examination will suffice to complete the diagnosis; in protracted cases the examination should be repeated. Perfect familiarity with Günzburg's and Uffelmann's reagents is requisite. Also one must be able to ascertain the total acidity, and the amount of free hydrochloric acid and of the organic acids. Toepfer's method is satisfactory for this purpose.

When the diagnosis is established the physician should address his attention, first, to the immediate relief of the symptoms; second, to the discovery of the cause, so that by its removal recovery may be obtained. The first step in the

relief of symptoms should be to adjust the diet to the conditions. Here considerable experience is necessary, but there are a few well-defined governing rules. A milk-diet generally affords comfort. The milk is best taken hot, but not boiled, and it is useful to add a little lime-water or peptogenic powder. About six ounces should be taken, slowly, every two hours. When the stomach has had a little rest, as a result of the diet, and hence when its irritability has subsided, a little well-cooked dry, starchy food may be added twice or thrice daily. It is important that the bread should be good and well baked, and it should be carefully masticated. No fluid should be taken to moisten the bread, as the necessarily increased salivation is desirable. One of the most satisfactory preparations to be taken at this time is that known as "zwieback." Unfortunately this name is applied to widely different preparations, some of which contain too much sugar, fat, and eggs, to be permissible.

Later, an egg uncooked or soft-boiled, once daily, should be added to the diet-list. As the solids are increased, the milk should be diminished. Last of all, meat may be allowed. Experience shows that this is best taken at the evening meal, which henceforth should be the principal meal of the day. No milk should be allowed the patient near the meal-hour at which meat is taken.

A week will probably elapse before the patient can be brought to a state in which three meals of solids can be permitted. Then, as a typical dietary, the breakfast should consist of a soft-boiled egg, a dry but warmed-over roll, and a bit of broiled bacon. In the middle of the forenoon a glass of hot milk should be sipped. At noon a liberal amount of "zwieback" and a glass of hot milk should be allowed; in the afternoon a glass of hot milk again; and at evening a plain but substantial dinner should be taken. This dinner may consist of fish, roast beef or mutton, or a boiled joint, with fresh vegetables, but no dessert. All highly flavored or seasoned soups should be omitted. Occasionally weak tea is harmless, and coffee generally agrees at breakfast.

In the arrangement of this dietary one important matter is kept in view, and that is to provide during the active part of the day those foods that are least likely to stimulate the secretion of hydrochloric acid, and also to give the milk at that hour between more substantial meals when the stomach is most likely to be empty, and therefore when the gastric juice would be most likely to irritate the stomach. By keeping such a stomach busy with the proper kinds of food there is a gain in several ways. The gastric juice is diverted to the process of digestion; the irritation is overcome; the patient under increased nourishment gains in strength; and, if the milk is not allowed to embarrass the evening meal there will occur little trouble from lactic-acid or other fermentation.

Very often the distress that comes about when the earlier and lighter meals are practically disposed of will disappear like magic when the patient sips his glass of hot milk. Occasionally patients are unable to take milk without discomfort, but it will usually be found that such cases suffer from an excess of

lactic acid in the early stage of digestion. Occasionally a diet of lean beef taken at short intervals with an abundance of pure water is the more satisfactory.

Besides the diet, very much may be accomplished by medicinal remedies. It is a well-established therapeutic principle that when there is marked disturbance of the stomach the function of the intestines and of the liver becomes deranged. In hyperchlorhydria there is frequently constipation, with putrefactive changes in the intestines; also the liver becomes functionally depressed and at intervals tender and large from congestion. At such times it will be found that five grains (0.32) of calomel or gray powder, given with sodium bicarbonate, and followed in the morning while fasting by a liberal dose of sodium sulphate, or Carlsbad salts dissolved in half a pint or a pint of hot water and slowly imbibed, will afford great relief, not only in correcting the condition known as biliousness, but also in diminishing the gastric hyperacidity and its attending symptoms. It is also very important to lessen the acidity by means of alkalies and to soothe the irritated gastric mucosa with sedatives. A combination that I have prescribed for years, and that is known as the "gastric sedative," best meets the indications. It consists of—

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|---|---|
| ℞ Cerii oxalatis, | 1. (gr. xv); |
| Bismuthi subcarbonatis, | 2. (gr. xxx); |
| Magnesii calcin. levis, | 4. (ʒj).—M. |

Of this a teaspoonful should be taken stirred well in a claret-glassful of water at the first intimation of gastric distress; that is, one or two hours after eating. When the intermediate glass of hot milk seems to relieve the symptoms, the powder may be omitted until evening, when it will be demanded. In more severe cases, the sedative will have to be prescribed between the stated potions of milk, or it may replace the milk between the hours for meals. The dose may have to be repeated, and its effectiveness is increased by taking it suspended in water, so that the lining of the stomach may be laved with the alkaline-sedative mixture.

When the urgency of the symptoms demands oft-repeated doses, the magnesia will exercise its laxative effect upon the bowels. Within certain limits this is desirable, but, at times, the dejections become too frequent. In such an event, it is wise to prescribe temporarily, to be discontinued as soon as the bowels are quieted, the following:

| | |
|---|---|
| ℞ Cerii oxalatis, | 1. (gr. xv); |
| Bismuthi subcarbonatis, | 2. (ʒss); |
| Bismuthi subgallatis, | 2. (ʒss); |
| Cretæ præparatæ, | 4. (ʒj); |
| Carbonis ligni pulv. | 4. (ʒj).—M. |

Of this a teaspoonful stirred in water should be taken, following the same rules as to its administration that have been laid down for the preceding pre-

scription. It is sometimes convenient to administer these powders alternately. The second prescription is successful in slowing the intestinal current. Sodium bicarbonate, so much employed by Continental writers, is not so efficacious as the powders described. No single agent succeeds as well as judicious combinations. In certain cases it is desirable to use sodium bicarbonate alternately or in combination with the foregoing prescriptions. The time-honored lime-water, or lime-water and milk, appears to suit some individuals particularly, but, on the whole, no one prescription is as satisfactory as that described as the "gastric sedative."

*Gastroxynsis.*—This term is used to describe a condition in which there is secreted a very great excess of hydrochloric acid, sometimes amounting to five or six parts per thousand, attended with gastric distress and sometimes with gastralgia, often accompanied by eructations of gas and vomiting of an excessively sour, and perhaps perfectly clear, fluid. The patient finds that eating increases his suffering, and as a result he loses flesh through inanition. Nervous excitability generally forms part of the complex of symptoms, and from loss of food and sleep, together with mental and physical suffering, the patient is reduced to a state that in some instances suggests malignancy and in others melancholia. This neurosis is believed to depend upon central nervous trouble, and has been compared by Ewald to an attack of migraine.

Occasionally the disease is very persistent and does not assume the paroxysmal type that is more commonly observed. In the treatment of this affection the regulation of the diet should be governed by the same rules that have already been described. As for medication, the "gastric sedative" is of positive value, but it will usually be found necessary to prescribe some form of opium immediately before meals. As a rule, codein in reasonably full doses will be found least objectionable, although I have sometimes been better satisfied with the so-called "old opium-pill"—that is to say, a pill that has become hard from long standing, and therefore one that dissolves more slowly in the stomach. Besides this the patient should be sent to the seashore or to some mountain-resort that is not too high, and required to lead a quiet out-of-door existence. Gastroxynsis occasionally leaves as suddenly as it appears, and unless the patient fails from some intercurrent affection the condition eventually wears itself out, sometimes leaving the victim with a dilated stomach, or with complete absence of free hydrochloric acid. It is possible in certain cases to mistake peptic ulcer for gastroxynsis. In those instances from which pain, tenderness, and gastrorrhagia are absent, but in which hyperchlorhydria in an astonishing degree appears, one can only speculate as to the diagnosis.

It is proper before leaving the subject of hyperchlorhydria to revert for a moment to what has been said on the etiology of functional disorders of digestion. Uncomplicated hyperchlorhydria rarely develops without an exciting cause remote from the stomach. Gastroxynsis is not unusually preceded or accompanied by excessive mental tire; and some form of brain-irritation, frequently resulting from eye-strain, will be found to precede in simpler and less pronounced forms of hyperchlorhydria. As before stated, it is usually inex-

pedient to attempt the complete restoration to health without the removal of the exciting cause.

*Total Acidity.*—It is necessary for the physician to keep constantly in mind the total acidity of the gastric contents, and he must know upon what acid or acids this depends. As has been stated, there frequently occurs an excess of hydrochloric acid in the early stages of digestion, but, while the total acidity is found to rise several hours after the ingestion of food, this will be found to depend not upon the further increase of hydrochloric acid, but upon the presence of acetic and butyric acids. Undoubtedly, these are dependent, as a rule, upon the fermentation of saccharine and starchy substances, or they may be derived from the lactic acid present in an earlier stage of digestion. There are, however, certain cases in which lactic acid is present in great excess and continues long after it is acceptable to comfortable digestion.

**Lactic-acid Excess.**—Lactic acid is found for a period of about half an hour after meals in the stomachs of healthy individuals subsisting upon an ordinary mixed diet. When there is deficiency or absence of free hydrochloric acid, lactic acid continues later than the period mentioned, and may be continually present in the stomach-contents. With a mixed diet the proportion of lactic acid present often bears an inverse ratio to the amount of free hydrochloric acid. If from any cause there exists impaired motility of the stomach, particularly when coupled with a diminished amount, or with an absence, of free hydrochloric acid, lactic acid may persist for a considerable period after the meal, or it may be constantly present. When there is an abundance of free hydrochloric acid, even in the event of food-stagnation, lactic acid may be absent. The explanation of these phenomena probably rests upon the fact that most of the lactic-acid-producing bacteria do not thrive in the presence of free hydrochloric acid, and also upon the fact that these bacteria flourish best in the presence of saccharine and starchy food.

Food-stagnation, from whatever cause, is very prone to be accompanied by lactic-acid fermentation, but, as before stated, when the free hydrochloric acid is abundant the fermentation may be prevented and lactic acid be found absent. This is true even in the case of carcinoma. So it will be seen that lactic acid is not always in excess in carcinoma of the stomach. Indeed, it may not be present in carcinoma even when free hydrochloric acid is absent, provided the motor function of the stomach is not disturbed.

Chronic catarrhal gastritis induces conditions favorable to the development of lactic acid, but unless food-stasis exists to an unusual degree lactic acid may be present only in small amount during the later hours of gastric digestion, unless it be introduced with the food in a preformed state. With some individuals, free from any structural disease of the stomach, lactic-acid fermentation is common, even in the presence of free hydrochloric acid. In such instances the free hydrochloric acid is deficient in amount, and the occurrence of lactic acid under these conditions depends, for the most part, upon the introduction of foods containing lactic acid or of those that very readily undergo lactic-acid fermentation. In functional disturbance, therefore, the presence of

lactic acid may be obviated by a proper restriction of diet. Occasionally in those stomachs that are peculiar in secretion, sometimes forming free hydrochloric acid in excess and sometimes producing it in small amounts, there may be difficulty in providing a suitable diet for several days together. For instance, an albuminoid diet might not be comfortably digested in the absence of free hydrochloric acid, and if recourse is had to milk or starchy foods lactic-acid fermentation occurs. Again, as has been stated, there are some cases of hyperchlorhydria that do not do well on an albuminoid diet. Such patients might get along on a diet of milk so long as the hydrochloric acid is in excess, but when the period for its disappearance arrives the milk readily undergoes lactic-acid fermentation. From a lactic-acid point of view these patients should be treated much after the manner already described, that is to say, an effort should be made to improve the general health by prescribing an out-of-door life, with judicious exercise and baths, when it is found impracticable to bring about improvement by an albuminoid diet and lavage. A diet of meat does not necessarily exclude lactic acid, as sarcolactic acid may exist preformed in meat or develop therein during the process of digestion. While this fact should be remembered, it is scarcely a source of hindrance in the management of the cases under consideration. When free hydrochloric acid is uniformly deficient or absent, lactic acid commonly occurs as a serious embarrassment to digestion, and many times it gives rise to a condition of toxemia that in turn originates a train of symptoms that may obscure the real state of the trouble. Many persons are victims of this form of indigestion who do not suffer from symptoms referable to the stomach. They present a muddy skin and complain of an unpleasant taste in the mouth; the urine contains lithates, phosphates, and oxalates in quantity, and as a rule an excess of indican. The urea is usually diminished in amount. I have occasionally found cystin-crystals, and in one case in which I found a calculus of cystin the cystinuria apparently depended upon the state of the primary digestion. When the lactic acid in the stomach was overcome the cystin-crystals disappeared from the urine. The alvine evacuations are generally dark, offensive, and insufficient. There are the symptoms of so-called biliousness, general muscular weakness, and sometimes moderate emaciation. Individuals who suffer discomfort from a milk-diet are usually victims of lactic-acid tendencies.

The history of cases seems to show that after a long period of suffering the hydrochloric acid becomes relatively diminished and the organic acids relatively increased, and it is advisable to prevent this change, as it is difficult to overcome persistence of lactic-acid disturbance once established.

The attempt has long been made to oppose the formation of organic acids by the introduction of drugs that are supposed to prevent fermentation. Medical journals and text-books have teemed with formulæ having this object in view. It must be confessed, however, that but poor success has attended these efforts, and while something may be accomplished by the use of antiferments, more may be accomplished by the selection of a proper diet and by the general management of the case. It is here that a diet of lean meat and hot water, so

much recommended by some, is most serviceable, and when it is thoroughly adhered to it is unquestionably followed by better results in the majority of cases than is any other method of treatment. The meat should be from a good cut, and should be finely minced or scraped. The white fibrous tissue should be removed, and the mass formed into proper shape and slightly broiled. Several ounces of this should be taken every four hours during the day, and it is often wise to precede the meal with tincture of nux vomica and follow it with hydrochloric acid.

Most individuals when limited to a single article of diet soon feel a repugnance for it, and are clamorous for a more extended dietary. It is a good plan, however, to persist in this diet without variation until the excess of lactic acid is overcome. As a rule, this object is eventually attained, and then the diet should be gradually widened, beginning with an occasional raw egg in sherry, then adding a little stale bread taken at one of the three meals only, and gradually reaching a mixed diet as the digestion becomes nearly normal and the general health is improved.

Some patients are made ill by a strict meat-diet, and are unable to take a sufficient amount of lean meat to maintain proper nutrition. In such cases it is sometimes advisable to prescribe meat once a day, and raw eggs at other times; the latter should be taken unbeaten from a small sherry-glass and should be covered with a teaspoonful or two of dry sherry, or, what is sometimes better, good cider-vinegar. This alternation in albuminoids sometimes relieves the monotony of the diet. When it is impracticable to continue this method a mixed diet may be adopted, but milk and all foods cooked with milk must be excluded. The bacillus acidi lactici, the most important agent in the production of lactic acid, is the common cause of the souring of milk, and while it flourishes in the stomach when carbohydrates are eaten, it is particularly disturbing in the presence of a milk-diet when the percentage of free hydrochloric acid is small. Great relief is afforded under these conditions by gastric lavage, and it is a good plan to use a saturated solution of boric acid for irrigating the stomach. Toward the end of lavage a solution of potassium permanganate, in the strength of four grains (0.26) to a pint (500.), is serviceable as a disinfectant. When the mucous membrane is irritable, the greatest comfort is afforded the patient by introducing through the tube a dram (4.) of bismuth subcarbonate stirred up briskly in a glassful of water after the stomach has been thoroughly washed. This is a soothing application to the irritable mucosa and constitutes a useful expedient in many stomach-disorders. After its employment the patient should fast for a few hours in order to afford the stomach repose.

Probably the best antiseptic for the stomach and one that gives more relief than any other of its class is benzonaphthol. This should be taken in doses of from 5 to 15 grains (0.32–1.), and it should be given every two or three hours according to the extent of the fermentation. A beneficial preparation is chloroform-water, which may be taken every half-hour or every hour in teaspoonful-doses. Menthol, in half-grain (0.032) doses in solution or

sprayed into the stomach after the method of Einhorn, is sometimes very satisfactory.

In exceptional cases great good follows the introduction of from two to five grains (0.13–0.32) of resorcin dissolved in alcohol, and a tablespoonful of pure glycerin or sodium sulphite in doses of ten grains (0.65) sometimes affords relief. Too much must not be expected, however, from drugs given with the view of preventing fermentation, for commonly they accomplish but little as compared with other methods.

An effort should be made to stimulate the production of hydrochloric acid by the use of gastric faradization and by the administration of tincture of nux vomica, or rasped nux vomica, in large and increasing doses before meals, following the meals by twenty or thirty drops of dilute hydrochloric acid and a few drops of spirit of chloroform given in tincture of bitter orange or in some other proper vehicle. It is often wise to repeat the dose of hydrochloric acid after the lapse of an hour. The patient should not be allowed to limit too much the amount of food taken in twenty-four hours, as it is important to improve the general health as much as practicable. Much assistance may be had by requiring the patient to remain in the sunlight and to exercise in the open air. Coldness and dampness always lead to increase of functional gastric disturbance, and an active life out of doors in a dry sunny climate is many times the only remedy necessary. Much more has been written on the subject of hyperchlorhydria than on that of lactic-acid excess, but in my judgment Allen Jones is correct in considering the lactic-acid state the more harmful condition of the two. Even when lactic acid disappears during digestion, the other organic acids, to the formation of which it so much contributes, frequently remain to swell the total acidity and derange the gastric chemistry.

**Diminished Acidity and Anacidity.**—The physician should appreciate the importance of knowing the degree of gastric acidity. In many cases this will be found very low; occasionally the reaction of the gastric contents remains neutral, or but faintly acid, for a long time—that is, when slight acidity is present there may be persistent absence of hydrochloric acid, and as a natural result the peptonization of albuminoids is not accomplished, and the patient thereby suffers from innutrition and from toxemia the result of decomposition of the gastric contents; or else Nature comes to the rescue by hurrying the contents onward through the pylorus before untoward changes have occurred in the food, and thus making it possible for nutrition to be maintained by means of intestinal digestion and absorption. The condition of gastric anacidity occurs both as a functional disturbance, in which the peptic glands seem to be inhibited in their activities, and as a structural disease in which there is degeneration and atrophy of the gastric mucosa. In a series of twelve cases of this affection there was found to coexist a high degree of astigmatism. Many cases of anacidity present a history of probable hyperchlorhydria, and I have seen several cases proceed from hyperchlorhydria one year into anacidity the next; so that I am inclined to believe that in the majority of instances the

depression of gastric function is preceded by a high degree of gastric excitement. This point in the natural history of the affection is important from the standpoint of treatment, and will throw light upon those cases beginning with mere functional disturbances, and going on from bad to worse until there is not only loss of functional activity, but atrophy of the mucous membrane of the stomach, and hence continued disability.

*Anacidity.*—Because free hydrochloric acid in the gastric contents is not discovered, it must not be inferred that none has been secreted, as examination may prove that free hydrochloric acid has been present during some part of digestion and now is found in the form of combined chlorids. When the free acid is not discovered it is a favorable indication to find a good biuret-reaction.

This subject will receive further consideration in the section on atrophy of the gastric mucosa. At this time it is intended merely to draw attention to the fact that such atrophy sometimes occurs as a direct result of long-continued functional depression, and of this gastric anacidity is an important symptom. It is not to be supposed that when food-stagnation occurs from gastrectasis, associated with the disappearance of the gastric secretion, organic acids the result of fermentation are absent. On the contrary, there may be found lactic acid; acetic and butyric acids may be present as a result of fermentation, but their occurrence is accidental and they usually disappear after a few days' treatment with lavage.

The management of this important affection should be well understood, and above all the cause upon which it depends should, if possible, be determined. It is not enough to oppose the anacidity by continual administration of hydrochloric acid, for, although this affords temporary relief, it does not materially assist in the restoration of function. Correction of some preceding reflex or constitutional cause should be attempted, and then the restoration of function by the long-continued employment of internal gastric faradization should be attempted. In the meantime the diet requires the patient's attention. Einhorn has suggested that it is better to treat the stomach, so far as diet is concerned, as though it were a part of the intestine, and advises a diet of very thoroughly cooked starchy foods, the changes in which may be accelerated by the employment of extract of malt and pancreatin. This is unquestionably the proper view to take of the matter. Experience has taught me, however, that the majority of patients do best if allowed a certain amount of albuminoids at one of the three meals during the day. The advice therefore is usually given to take the starchy foods as already recommended at the morning and noon hours with extract of malt or pancreatin, and no hydrochloric acid. At the evening meal a liberal amount of albuminoids is permitted, and hydrochloric acid and pepsin are given thereafter in liberal and repeated doses. In the morning, while yet fasting, the stomach should be emptied and thorough faradization employed by means of the gastric electrode. These cases, if of long standing, are tedious, and months of weary application of electricity, together with certain remedies, are required before the first appearance of free hydrochloric acid rewards the continued efforts. When the case is of short standing the return of the gastric secretion is not long delayed, and it some-

times happens that the pendulum swings too far the other way and an excess of hydrochloric acid is secreted. Thus are the steps in the pathology retraced, and the physician occasionally finds himself dealing with hyperchlorhydria in a case in which he began with the treatment of anacidity. The drugs employed are such as are likely to stimulate the gastric innervation, and to some extent to restore the general health. Foremost among these is nux vomica, preferably in the form of a coarse powder, of which two or three grains (0.13-0.19) should be given before meals. Sometimes great benefit follows the use for a short time of doses of 5 or 10 grains (0.32-0.65) of powdered capsicum. It is necessary to be careful lest the continued stimulation of the gastric mucous membrane result in the development of gastric catarrh. With the appearance of gastric irritability, such remedies should be abandoned, and soothing measures like bismuth and cherry-laurel water should be substituted. A good prescription is one of 10 grains (0.65) of bismuth subcarbonate suspended in an emulsion of chloroform-water, cherry-laurel water, and powdered althea. It is wise at such times to abandon the albuminoids, and all foods should, for a short period, be cut down to the lowest point practicable. Very soon the symptoms will subside and then the original plan may be reinaugurated. Such patients occasionally have a great craving for acids, and it is sometimes advisable to satisfy this desire by allowing half a pint of claret with the evening meal. When cases of anacidity are attended with gastric catarrh, the treatment must be modified accordingly. Gastric catarrh has been too often held responsible for the great majority of all functional disturbances of the stomach. In point of fact it is, when present, often the result and not the cause of the gastric disorder, and it should be treated as an accident, and not as the foundation of that which is sought to be removed.

**Intermittent Anacidity and Hyperacidity.**—Amongst the most interesting of functional disorders of the stomach are those that reveal themselves by the alternating presence and absence of gastric secretion. Occasionally, it will be found that free hydrochloric acid exhibits itself during certain hours of each day. In other cases it is persistently present, and even in excess, for several days together, and then fades away, and anacidity prevails for a longer or shorter interval. It is probable that this disorder of the physiologic processes of the stomach results from an irregular innervation of the organ—that is, the stomach is temporarily thrown into a state of excitement, which is, in turn, followed by a poor supply of nervous energy, when the viscus is left in a state of paresis, as it were. In a number of instances it has been noticed that individuals who had normal secretion under favorable surroundings would at once develop anacidity if subjected to mental strain or other forms of brain-irritation. The same result has been observed to follow physical overtaxing, and from this the belief arises that functional anacidity is usually the result of transient or persistent exhaustion of nervous energy. The treatment of these alternating cases is sometimes extremely embarrassing. The stomach-contents must be examined with sufficient frequency to guide one in the relatively rapid changes in treatment, for sometimes the excessive secretion must be met with

alkalies and sedatives, while on the next day, in the place of antacids, hydrochloric acid and stimulants are demanded. It is wiser in such cases not to depend too much on local or special treatment, but to so treat the patient that his general health will be restored; and, as usual, this means an out-of-door life, with such exercise, in the nature of recreation, as is consistent with the patient's strength.

**Gastralgia.**—The symptom of gastric pain depends upon such diverse conditions and varies so much in intensity and character that it cannot be regarded as always a single affection. As has been stated, pain is very frequently accompanied by hyperchlorhydria, and doubtless occurs as a result of the irritation of the gastric mucosa by the excessively irritating gastric contents. In such cases the pain usually appears about two hours after the ingestion of food and continues until the stomach is empty. It is not much relieved by stimulation of any kind, but sodium bicarbonate, magnesium carbonate, and the salts of bismuth generally dissipate the suffering with promptness. Pain occasionally accompanies anacidity. When it does, it is usually the result of what is sometimes called essential gastralgia. In this affection the pain seems often not to bear much relation to the secretory activity of the stomach. It is true that in prolonged cases the secretion usually diminishes, probably from deficiency of innervation.

True gastralgia is generally sudden in onset and is sometimes observed to occur at the same hour each day. Again, it occurs irregularly and may continue for days or weeks together. As a rule it persists for a few hours, or at the most for two or three days, then gradually subsides, to reappear under suitable conditions, which will usually be found to reside in a tired nervous system. There are various degrees of intensity of this affection, and it is capable of becoming most agonizing. Syncope may result, and there is occasionally very great prostration. The attacks are often taken for the pain of peptic ulcer, the passage of biliary concretions, or angina pectoris. For immediate relief it is at times necessary to use morphin hypodermically. One full dose will usually suffice to give relief, but it may have to be repeated from time to time.

Little or no food by the stomach should be allowed. The patient should receive rectal alimentation and, above all, at the earliest practicable moment the continuous electric current should be applied to the gastric mucosa by means of a gastric electrode, the positive pole within the stomach. The strength of the current should be from ten to twenty milliampères, and the sittings should occupy about five minutes. The effect is eminently satisfactory, not only in relieving the paroxysms, but as a successful measure for overcoming the affection. Relief is often experienced in consequence of frequent and rather long-continued lavage with water made as hot as is tolerable. Large doses of quinin, suggested years ago by Austin Flint, are of service, and some relief may be had from atropin, cannabis indica, or antipyrin. Morphin is the most reliable agent for temporary relief, and the continuous electric current the only satisfactory remedy for cure. Of course in such urgent cases but little persuasion is necessary to obtain the consent of the patient to take that which is usually

most needed—rest and recreation. It is wise, however, not to allow the patient to depart until a proper course of electric treatment has been pursued.

Gastralgia differing in type from that just described is occasionally found as an expression of hysteria. In the management of such cases, besides the treatment already prescribed, it is necessary to resort to the cold spinal douche and large doses of milk of asafetida, and the application of general faradization—the usual treatment required for the hysterical. The treatment of other forms of gastric pain is so intimately connected with special conditions described hereafter that their further consideration at this point is unnecessary.

**Gastric Hyperesthesia.**—There occurs an irritability of the stomach, in no way connected with inflammation of the organ, in which a feeling of uneasiness and weight, or, as patients often describe it, "rawness," is experienced which occurs as a symptom of general neurasthenia, or which may be the result of nervous depression apparently limited to the stomach. In such cases the gastric chemistry may or may not be disturbed. The condition is aggravated by food, and the statement is often made that the result is the same no matter what diet is selected. The source of the trouble is to be found in some disturbance of the general nervous system, often depending upon irritation of its centers. Frequently, relief follows the support of a retroverted uterus, the curetting of the endometrium, or the soothing of an inflamed ureter, bladder, or urethra, or the correction of an existing hyperlithuria. Hysteria, again, may be the disturbing element, as may be chlorosis, or a toxemia resulting from constipation.

There remain to be thought of measures for the immediate relief of the gastric hyperesthesia. Although the suffering is usually intensified by eating, the patient should, nevertheless, be ordered a full and nutritious diet. Before meals a solution containing half a grain (0.032) of menthol may be taken, or there may be given 5 grains (0.32) of resorcin, or 1 or 2 drops of carbolic acid, or 5 or 10 drops of dilute hydrocyanic acid, or half an ounce (15.) of chloroform-water, or 10 grains (0.65) of cerium oxalate, or other gastric sedative. On the other hand, it will sometimes prove most satisfactory to employ stimulants. Cognac, absinthe, the compound spirit of ether, capsicum, aromatic spirit of ammonia, are among those that may be tried. Occasionally drafts of very hot water before eating afford great relief, but the application of the continuous electric current is most satisfactory. Much benefit follows external treatment in the form of the hot abdominal pack, or in the alternating hot and cold stream applied over the epigastrium for a period of five minutes once or twice daily.

**Hunger and the Feeling of Emptiness.**—Closely allied to the condition just described is the sensation of hunger that is often present without appetite. This neurosis is of central nervous origin, and its relief will not follow treatment directed to the stomach alone. In exceptional cases the absolute denial of food for a short time restores the appetite and enables the patient to relieve the hunger. More often this measure but aggravates the trouble, and it is spoken of more as a warning than as a recommendation. When the patient

has a great disgust for food, and finds it impossible to maintain proper nutrition, there remains one remedy, and this is the method of forced feeding by the mouth known as "gavage." The stomach-tube having been introduced, a pint or more of nutritious fluid or semifluid food should be introduced at least twice a day. This measure is not so troublesome as might be supposed, and experience proves its usefulness. Particularly in cases in which the disturbance is apparently a psychosis, gavage is of inestimable value.

A different class of cases includes those in which there is not only hunger but also appetite. Here the patient is never able to satisfy his cravings, and the stomach is usually kept distended with undigested food. Such patients are often thin, thus showing that assimilation is faulty. Quite often the affection is seen in children. Besides attending to the general health, the patient should be restricted as to the amount of food and the number of meals, and his primary digestion should be improved by accepted methods. The long-continued indulgence of the patient results in dilatation of the stomach and in exhaustion of the digestive functions. In some instances of bulimia there occurs an incredible desire for unusual articles of diet. It is not often found that patients will eat disgusting things, except when we have to deal with a true psychosis. It is comparatively common to find patients who demand, for instance, meat continuously, or fruit, or starchy foods. I knew a woman who constantly craved starch such as is used by laundrymen. Nothing is to be gained by satisfying these unnatural desires. It has been said with reason that the alcoholic habit has been created by the constant imbibition of small quantities of alcohol taken for the relief of the constant craving for something. Temporary benefit is to be derived from the frequent introduction of some form of stimulant, but in the end the effect is pernicious.

It is well to advise a course of tonic treatment, and arsenic stands, perhaps, at the head of the list. It should be given in large doses and be continued until its physiologic effect is manifest. Hydrotherapy is also of great advantage, not only when applied to the epigastrium, but also in the form of the cold spinal douche or of cold affusions, or of the cold wet-sheet. General faradization and massage are of assistance.

**Anorexia.**—The loss of appetite so often existing as a symptom of widely varying diseases occurs also solely as a functional disturbance without other discernible disease. It sometimes occurs alternately with excessive appetite; at other times it is present during certain hours of the day only. Before instituting treatment the physician should satisfy himself that he has not to deal with a symptom resulting from some defect of the organs of elimination, particularly the kidneys and the liver, and he should be sure that there does not exist some gastric disease, structural or otherwise. It may not be amiss at this time to call attention to the importance of making very thorough and general examination before dismissing the case as one of nervous anorexia.

When the diagnosis is secure, the treatment is evident. It consists in the administration of a definite amount of nourishment at stated intervals, and when this proves objectionable to the patient, and when nausea has existed, it

is far less troublesome and more successful to resort immediately to gavage. The stomach-contents should be examined with sufficient frequency to enable the physician to fortify his faith that the gastric chemistry is correct. It should not be forgotten that in these nervous cases disturbances of secretion may occur one day and be absent another. Anorexia nervosa should receive the same general attention demanded by other neuroses.

It often occurs that the same neuropathic faults that have occasioned anorexia also lead to functional defects in other organs. This is particularly true of hysteria, of which anorexia is often an expression. One of the most common causes of anorexia is renal insufficiency, and often there will be found an overloaded intestine, even when daily dejections are had. I have seen anorexia nervosa disappear in not a few cases under the influence of the daily hot-air bath to produce profuse and prolonged sweating; other cases are relieved by enteroclysis. Possibly something may be accomplished by stimulating diuretics, although in practice they are usually found unnecessary. These remarks on elimination are especially applicable when forced feeding is practised.

**Nervous Vomiting.**—This condition very frequently depends upon reflex irritation, but there are cases in which no such causes can be determined. When such irritation is removed, improvement is occasionally immediate; yet there are other cases in which the nervous system becomes so disturbed by the long-continued habit that a prolonged course of treatment is necessary, even after the removal of reflex causes. One of the best modes of treatment is irrigation of the stomach by means of the tube, followed by the application of the continuous electric current. Relief sometimes follows quickly the application of the actual cautery to the epigastrium or along the lower cervical and upper dorsal vertebræ. Absolute rest for the stomach for forty-eight or fifty-six hours is a useful and often necessary expedient; during this time rectal feeding should be practised. When nourishment by the stomach is resumed, it is well to begin by gavage after the stomach has been thoroughly irrigated. Prolonged rest in bed, with massage and Swedish movements, is demanded in not a few cases unless for some reason contraindicated. General faradization for from fifteen to thirty minutes usually produces good results. These methods have a wholesome mental effect upon the patient, which is of some consequence in dealing with this affection. It is a common experience to find such stomachs willing to receive a certain article of food only, and it is proper to satisfy the inclinations of the patient in this respect, unless the character of the food is unreasonable. The gain from the use of nervous sedatives is often considerable, and by resorting thereto the physician may the more readily overcome a paroxysm. The use of such measures is undesirable as a routine practice, as the cause is thus not reached and as the patient is sometimes made worse by the remedies. Morphin hypodermically is most often resorted to, and while it frequently succeeds, its disadvantages are well known. Sometimes a full dose of chloral *per rectum* or large and repeated doses of the bromids are less objectionable. When sleep is demanded, something may be gained by using chloralamid dissolved in whisky and introduced *per rectum*.

As to the local treatment of the stomach, this method is usually first adopted, but as a rule it is of least avail. When there is evidence of gastric irritability, as shown by the more abundant mucus that is vomited, particularly when this is blood-stained, it is advisable to employ gastric sedatives. Cerium oxalate, bismuth subnitrate, carbolic acid, cocain, and cherry-laurel water are the remedies to be thought of. When powders are selected they should be administered stirred up in an ounce or two of water, and this is rendered more agreeable by the addition of a little tasteless mucilage, as for instance that made from marshmallow or gum acacia. Chloroform-water, alone or combined with cherry-laurel water, is a simple and useful remedy. Carbolic acid or menthol may be triturated with the light calcined magnesia and stirred in water immediately before administration. It is a mistake to administer powders dry upon the tongue, allowing them to be washed down thereafter, as much of the possible good of the remedies is often thus dissipated. When there is little evidence of gastric irritation, stimulants may be employed. Freshly decanted champagne will meet the indications, and occasionally menthol or chloroform-water or a solution of cocain sprayed into the stomach through a tube succeeds admirably. A minimum amount of the medicaments produces a maximum amount of benefit when applied in this manner, provided the introduction of air into the stomach is not a disadvantage.

**Motor Disturbances.**—Under this head should be considered several conditions that are commonly regarded as disturbances of secretion. A proper conception of the matter may be had by recalling that with irritative conditions we may have associated spasm of the cardia or pylorus, or both, and there may also finally occur excessive gastric peristalsis, often reaching a condition properly called spasm, or continuing less violently, but still in movements unnaturally active, generally described as peristaltic unrest. Again, depressive conditions attended with relaxation of one or both of the orifices of the stomach are seen, or the entire organ may remain for a long time in a state bordering on paresis, in which little or no movement can be recognized. The study of the movements of the stomach is difficult, and much remains to be learned concerning these phenomena. Einhorn has recently contrived an instrument known as the "gastrograph," which promises to add to our knowledge on the subject.

**Eructation.**—One of the most persistent symptoms of stomach-disease is that of the eructation of gas. Sometimes this occurs in a violent, almost explosive manner, and a patient may become exhausted from the oft-repeated efforts. Eructation of gas may occur as an accompaniment of gastric fermentation, but this is not at all necessary, and, as a matter of fact, it is not present in a considerable proportion of cases. The symptom results from the incompetency of the cardia, which under very slight stimulation relaxes during gastric peristalsis, and as a necessary result gas is propelled upward through the esophagus. This is one reason why antiseptics do not oftener relieve eructations and why a simple carminative that stimulates the activity of the cardia often succeeds so well.

A simple expedient long ago prescribed by Dr. Leared will at times correct the symptom. This consists in the administration of dry, re-ignited, very finely powdered hardwood-charcoal. My plan is to have the charcoal re-ignited in an iron capsule, requiring it to be bottled while yet hot, and stopped with glass. The bottle should not be open save when necessary for the removal of a portion, and the dose, a heaping teaspoonful, should be taken wrapped up in a large wafer-paper. The object of this is to discharge the dry charcoal into the stomach so that its fine particles will spread upon the mucous membrane. Whether Leared's theory that the dry charcoal absorbs the gas is or is not correct, the fact remains that the remedy is often efficacious.

Sodium carbonate, and bismuth subnitrate, subcarbonate, and subgallate are all serviceable. I have not found bismuth subgallate more useful than other salts of bismuth. Purified beechwood-creosote and creosote carbonate occasionally afford greater relief. There is no doubt that decided advantage is sometimes obtained by systematic lavage with some antiseptic solution, followed by meals that afford the least opportunity for the development of organic acids.

**Pyrosis.**—The condition bearing this name is also usually dependent upon weakness of the cardiac sphincter and differs from eructation in the fact that the fluid contents of the stomach are regurgitated, instead of gas; the two symptoms go together, and pyrosis, like eructation, may or may not be associated with gastric fermentation. The treatment of these two conditions usually results in benefit, and yet eructation is sometimes one of the most intractable symptoms with which one is called upon to deal. The uselessness of prescribing antiferments will be learned by experience and understood from a knowledge of the cause of the symptoms. As a rule, sedatives give rise to greater relief. In some instances these agents fail and a stimulating treatment is necessary in order to assist the cardia in its contraction. While it is a somewhat contradictory measure, yet success occasionally attends the administration of the sedative combined with the carminative. The object of the former is to allay gastric peristalsis, and that of the latter to assist the cardia in maintaining its closure. Here again electricity is of great benefit, for while it may stimulate peristalsis, it at the same time strengthens the cardia and improves the general innervation to such an extent that a more orderly state of the stomach results.

Of course, the acidity of the gastric contents should be kept in mind, and, when it is found too high, alkalies must be employed. Certain food-substances invariably cause attacks of pyrosis, or eructation, or both, in certain individuals whose stomachs are usually well behaved. Here there is probably set up some disturbance of the gastric chemistry that stimulates excessive peristalsis. It follows that care should be employed in the diet, and careful selection of foods may aid in overcoming the habit. Patients should be cautioned not to practise belching on slight provocation. With some it is merely a habit, and in those instances in which large amounts of gas are expelled the patients swallow air unconsciously and return it in an audible and disagreeable manner.

Hydrotherapy is of marked use in some cases, and is most successful when applied in the form of the alternating hot and cold douche or affusion. Sometimes the alternating hot and cold pad will suffice when the patient has to make the application for himself. These measures should not be continued too long, as depression rather than stimulation may result. When the cause of the difficulty lies in the morbid state of the general nervous system, benefit will only follow improvement in general innervation, and therefore a change of occupation, with recreation for those who work too hard and regular duties for the idle, together with change in climate, constitute the most desirable therapeutic measures.

Relaxation of the pylorus is a more common condition than spasmodic closure. Although German writers doubt the existence of the latter, it seems to me that it is a reality. In no other way can one easily explain the fact of the periodic retention in the stomach of well-changed contents that do not pass downward for several hours after the ingestion of a meal, often with active peristalsis existing. Still, relaxation of the pylorus is relatively common.

In many of those who thus suffer, the condition may be suspected from the complaint of a peculiar lienteric diarrhea. Soon after food is taken, and before leaving the table, the patient feels a commotion in the abdomen and experiences an urgent desire to evacuate the bowels. The alvine evacuations are often accompanied by loud borborygmi and the expulsion of much gas, and in the dejections may be found portions of the food but little changed. Probably this diarrhea occurs in cases of somewhat long standing; certainly there are numerous instances of rapid emptying of the stomach unattended with diarrhea. The latter condition is not as serious as the former, as by means of intestinal digestion patients maintain a fair nutrition, while the diarrheal cases almost always suffer from innutrition and are sometimes reduced to a state approaching starvation. For the immediate relief of such cases it is necessary to administer sedatives immediately before meals. Probably the most effectual is opium in small doses, three or four drops of the official tincture usually sufficing. It has seemed to me that doses of one or two drops of Fowler's solution assist the action of the opium. I have occasionally seen benefit from the taking of from 10 to 20 drops of spirit of camphor just before the patient goes to the table. One or two dram-doses (4.) of bismuth subcarbonate sometimes succeed, as does also the administration of cocain or carbolic acid, and rarely one-grain (0.065) doses of opium, with lead or other astringents, are necessitated. None of these remedies cures; they all simply relieve. Permanent benefit is more likely to follow intragastric faradization or galvanization and hydrotherapy, together with the removal of exciting factors, which often will be found to originate in reflex irritation; or improvement in the general health when there is found to be a neuropathic weakness.

**Merycism.**—This condition, sometimes designated rumination, has long been known, and is to be considered as a manifestation of a neurosis. It usually occurs in one member of a family only, but it has been observed as an hereditary affection.

The patients have not only the ability to return the stomach-contents into the mouth at will, but they have an instinctive desire to do this which is not easily overcome. The phenomenon is observed in hysterical patients as a temporary disturbance, but in these the psychic state accompanying the regurgitation is different. In cases of true merycism the patient may not suffer in general health, and even in cases of hysterical rumination patients are sometimes well nourished. As a rule, however, patients of the latter class lose a portion of each meal and are therefore emaciated. In hysterical cases the treatment should be that usually adopted in hysteria. When one has to deal with true merycism, nothing but continual training, with some firmness on the part of the attendant, will lead to the overcoming of the habit. Of course any neuropathic condition should receive appropriate treatment, but there seems to be known nothing more nearly specific for the controlling of this curious and sometimes disgusting complaint.

**Gastric Atony.**—We sometimes find that the stomach remains apparently motionless for prolonged periods, usually in association with incompetency of the cardia and the pylorus; digestion is as a result much disturbed and absorption is materially delayed. For a time the contents of the stomach find their way into the intestine, where digestion may be so far completed as to maintain a reasonable degree of nutrition. As a rule, there is loss of flesh, and many symptoms suggesting slow digestion are referable both to the stomach and intestines. There is often flatulence, and sometimes bile finds its way from the duodenum into the stomach, so as to occasion constant nausea, and bile-stained fluid may be ejected as a result of contraction of the abdominal walls. Gastric atony is not of itself so distressing, but it is prone to lead to dilatation of the stomach unless an early diagnosis is made and appropriate treatment practised. Lavage is an important means of treatment. Sufficiently skilful operators can lend valuable assistance by such manipulation of the abdominal walls as may stimulate the movements of the stomach and hasten the emptying of the organ at the proper time. An incompetent person merely distresses the patient, without relieving him, but there are a few sufficiently well trained in massage to be able to accomplish the utmost good. Faradization should be thoroughly tried.

In addition to these, remedies exercising a tonic effect upon the gastric apparatus should be employed in as full doses as practicable. A pill containing one grain (0.065) each of the oil of black pepper, the extract of nux vomica, and the extract of physostigma is one of the most serviceable combinations, and should be given before meals. Capsicum in doses of 4 or 5 grains (0.26–0.32) is very useful, and its action may be assisted by quinin and aromatics. Small amounts of cognac, champagne, carbonated water, or ginger-ale occasionally afford much assistance. I have employed ginger-ale, with a few drops of capsicum, which may be taken during meals. Various bitter infusions have been supposed to afford great benefit in the relief of what has been considered to be atony of the stomach. There is undoubtedly some benefit to be derived from this class of remedies, but the good has been

exaggerated. Infusions of quassia, calumba, and chiretta are among the best.

**Stenosis of the Cardia.**—This condition exists as a functional and also as a structural state. The former is the result of local or reflex irritation or a neuropathic condition, and the latter follows cicatrices occasioned by burns or other trauma, or it may result from neoplasms either outside the esophagus or involving the wall of the esophagus at the cardia. To differentiate between a stricture of the cardia and a diverticulum of the esophagus is occasionally difficult, but as the latter is usually found in the upper third of the esophagus, and as the stomach-tube may occasionally pass without obstruction, the diagnosis may be reached after proper study. To distinguish between organic and spasmodic stricture is often very embarrassing, and to recognize structural stenosis in cases in which both conditions exist (and this is not uncommon) is indeed perplexing. In the case of an hysterical man I found no difficulty in passing the esophageal tube after making a strong mental impression, or after the influence of an anesthetic, and following these measures the patient was able to eat without difficulty. Eventually the dysphagia returned, and, notwithstanding the benefit following gastrostomy, the man died from carcinoma of the cardia.

Experience leads me to differ from Ewald as to the frequency of carcinoma of the cardia. It is a peculiarity that the constitutional symptoms of malignancy are usually very inconspicuous in such cases. I have seen death follow carcinoma of the cardia in cases that showed no more cachexia than is sometimes observed in mere spasmodic stricture. One of the conditions that invariably accompany organic stenosis, and not infrequently spastic obstruction, is dilatation of the esophagus, a condition that must be borne in mind in formulating the treatment. In the management of spasmodic stricture it will be found that relief is often obtained from the passage of the sound. This maneuver is not always accomplished without trouble. If there is too great difficulty, an anesthetic may be employed. When the tube is in the stomach, it is well to introduce half a pint (250.) of fluid nourishment. This plan of passing the tube and nourishing by gavage will usually so influence the spasm that deglutition becomes possible. In the mean time every attention should be directed toward the relief of the neuropathic state that is usually present. These measures include the needle-bath, the cold spinal douche, and the alternating hot and cold needle-bath to the epigastrium. Faradization will prove useful, together with the internal administration of arsenic and the various nervines, among which asafetida, in large doses of the emulsion from the pure Calcutta gum, occupies the first place.

When the stricture is of cicatricial origin and unassociated with a new growth, but resulting from trauma or round ulcer of the cardia or of the esophagus near the stomach, it is wise to attempt dilatation by means of graduated sounds or, if this is impracticable, by the employment of electrolysis, using only a small ampèrage. I have witnessed success in several cases treated by this method. It must be admitted that the patients become so disturbed by the practice at a time when nutrition is defective and the nervous system disturbed that it often

becomes necessary to resort to gastrostomy as a preliminary detail. When the patient's general health has been improved by feeding through the gastric fistula the method described may be carried out successfully. In one case seen with my colleague, Roswell Park, there was a second recurrence of the stricture, which was each time relieved for a long period by electrolysis together with gradual dilatation by sounds. When one has to deal with a neoplasm it is best to resort to gastrostomy as soon as the dysphagia becomes at all troublesome. The patients suffer less inconvenience and there is less rapid deterioration when the gastric fistula is early used for feeding.

Before proceeding to operative measures the diet should be limited to fluids only, and those rich in nitrogenous substances should be selected. Raw eggs and milk, or beef-juice and claret, to which may be added some powdered beef, with the occasional use of leguminous gruels or gruels of flour with extract of malt, will be found most satisfactory. Acid wine or beer is sometimes gratefully accepted, and is serviceable. When there is an accumulation in the sacculated esophagus, that organ should be irrigated by means of the esophageal tube, with or without the addition of antiseptics. The care of the esophagus when the stricture is tight is of considerable importance, as the accumulation of saliva and morsels of food may give rise to considerable pressure, and fermentation of an offensive kind may occur. There is usually more complaint of dryness of the mouth and bad taste than of any immediate discomfort in the epigastrium. This state may be relieved by attention to the measures already mentioned. When pain occurs, it is usually of psychic origin, and is to be relieved by reassuring the patient and distracting his attention from the apprehension of starvation. The difficulty subsides after establishing the gastric fistula. Anodynes are rarely needed.

**Gastrectasis; Gastric Deformity; Pyloric Stenosis.**—These conditions are so intimately related as to warrant their joint consideration. Aside from the presence of neoplasms, the most common cause of pyloric stenosis is cicatrization resulting from peptic ulcer. Rarely, similar changes follow ulceration of syphilitic or tuberculous origin, or they may be occasioned by so-called phlegmonous gastritis. It is common to observe apparent obstruction associated with hyperacidity seemingly dependent upon spasm of the pylorus, which obstruction disappears when the gastric secretion is corrected. It is believed that true hypertrophy of the pylorus occurs in some instances, as in a classic case reported by Nauwerck. Undoubtedly obstruction results from malposition of the stomach, by pressure from inflammatory bands, and by outside pressure from other organs, new growths, etc. In my experience the most common cause of pyloric stenosis is carcinoma. This leads to obstruction, even when the pylorus is fairly patulous, as when the new growths invade the walls of the stomach near the pyloric extremity. Deformity of the stomach, aside from stenosis, frequently accompanies the conditions just described, and, besides deformity, displacement of the stomach is a matter of considerable importance in the etiology of gastric dilatation. The striking frequency with which gastrectasis accompanies wandering right kidney has often been com-

mented upon, and at least goes to show the relation between these events. There is much doubt as to whether one occasions the other, or whether they both follow some common cause. The assertion that both these conditions are favored by great relaxation of the abdominal parietes, while plausible, has not been verified in my experience.

An interesting and often troublesome deformity is occasioned by cicatrization following round ulcer situated midway between the extremities of the stomach, resulting in a so-called hour-glass contraction. I have seen three such cases, and in two was enabled to pass the stomach-tube, after some difficulty, into the second pouch, finding therein stomach-contents differing markedly in character from those found in the first. In one case there was marked dilatation of the first pouch, and in another dilatation of both the first and the second pouches. In the latter case a peptic ulcer was still present near the pylorus. It is possible that in such cases the condition may be mistaken for a gastric diverticulum, a rare though recognized deformity. It should also be understood that the size of the stomach varies greatly in different individuals and that no exact proportion exists between the capacity of the organ and the stature of the individual. It is assumed that in a fully developed man the stomach should not have a capacity greater than three pints. However, it is not uncommon to find stomachs much larger than this that present no symptoms of dilatation or other disturbance. It is therefore not proper to assume that the patient suffers from dilatation unless there are present the cardinal symptoms of this condition.

*Dilatation of the stomach* is occasioned by obstruction at the pylorus and later by loss of power in the gastric walls or by an association of these two. Both of these causes may be either functional or structural, and so the affection may be either curable or beyond improvement. In the great majority of instances improvement follows appropriate management. Most cases that are not directly dependent upon structural stenosis at or near the pylorus are due to atony of the gastric walls following or accompanying some of the functional disorders of the stomach. Germain Sée long ago pointed out the frequent association of hyperchlorhydria with gastric dilatation. My experience accords with his original statements, and in those cases in which anacidity exists there is usually a history pointing toward a past hyperchlorhydria. Several times I have seen the hyperchlorhydria accompanying dilatation fade away into anacidity within a period of a few months, and I am led to believe that the atony following a preliminary state of excitement shows itself in the relaxation of the muscular walls before it does so in depression of the functional activity of the secreting glands of the stomach.

As to treatment, a most essential matter, and one that is often disregarded, is the discovery and the removal of causes inducing the functional disturbance of the stomach that may be the exciting cause of the gastrectasis. Treatment directed toward the dilatation alone affords often but temporary relief. A wider view is necessary. When there is hyperacidity it should be corrected along the lines already laid down, and the patient should be put upon a nutri-

tious diet having the least possible bulk. Notwithstanding this precaution food-stagnation will at times persist, making lavage imperative. Rest for the stomach during the night, procured by lavage before retiring, is an admirable procedure, but then the heartiest meal should be given at mid-day, to allow sufficient time for its slow absorption and expulsion. Even this precaution is sometimes not enough to prevent loss of flesh in consequence of frequent emptying of the stomach. In such an event it is wiser to practise lavage on alternate nights, or the treatment may be applied in the early morning when the stomach is more often empty, thereafter allowing the patient to fast for several hours, so that the organ may temporarily obtain complete rest. It is of the utmost importance to secure the return of the proper gastric motility, and no agent is so useful to this end as intragastric faradization. In just such cases I like best the use of the electrode heretofore described by me, which allows the washing out of the stomach and the application of the electric current without the removal of the tube. Because electricity stimulates secretion as well as motion it is sometimes an embarrassment in instances of hyperchlorhydria with dilatation. The difficulty is not so great as first appears, for after the treatment the stomach may be irrigated with an emulsion of bismuth, which soothes the mucosa and, by the help of a little magnesia, neutralizes the acidity. Assistance may be had by expert massage of the abdominal wall, having in view the emptying of the stomach. But few are able to accomplish this feat, and yet when successfully done it is a measure of great importance. It is found that systematic physical exercise—as, for instance, moderate mountain-climbing, horseback-riding, or boating—assists materially in the restoration of the gastric innervation. As for drugs, the most useful are nux vomica and physostigma given in large doses. The other bitter tonics and the mineral acids seem to accomplish as much harm as good.

As already stated, the diet should be of little bulk and should be selected according to the gastric chemistry in the given case, as described in the section on functional disorders. The meals should be taken at long intervals, and the food should be finely subdivided and should be stimulating or non-stimulating according to whether there is excitement or depression in gastric secretion, and according as gastric catarrh is present or absent. The last-named condition is more likely to occur with dilatation depending upon structural disease than with that depending upon functional defect, and yet it may be excited by carelessness in diet or by an over-stimulating method of treatment. Its appearance should be met by the administration of a mercurial, the omission of faradization, massage, and other active measures of treatment, by the administration of gastric sedatives, and by limitation of the diet as far as practicable. As a rule, its continuance is but temporary.

Thirst in gastrectasis is sometimes immoderate, and should be satisfied for the most part by small and frequent drafts.

It is sometimes found advisable to give a large draft of some purgative water in the morning. It is usually necessary to employ a vegetable laxative to overcome the almost ever-present constipation. Of this group rhubarb and

aloes are the most serviceable, not alone because of their purgative qualities, but also because of their apparent good effects upon the gastric activity.

Sometimes, owing to putrefactive changes, diarrhea is established. This is usually preceded by characteristic vomiting of large quantities of yeasty stomach-contents that suggest the proper measures for relief. These are lavage with antiseptic solutions, such as a saturated solution of boric acid, or a solution of potassium permanganate, three or four grains (0.19–0.26) to a pint (500.), or a weak solution of hydrogen dioxid or of salicylic acid. The diet should be limited to substances least likely to undergo fermentation; and, finally, antiseptic drugs may accomplish something. The best of these is benzonaphthol, given alone, in 10-grain (0.65) doses; or, as recommended by Hayem, a combination of an equal amount of bismuth salicylate, sodium bicarbonate, and powdered charcoal may be used. The powdered charcoal, given in the manner hitherto described, is at times beneficial, as is also a watery solution of eucalyptol. When malignant disease coexists, these measures of antisepsis are usually more often demanded. However, as the real difficulty lies in food-stagnation, and as antiseptics exercise but transient benefit, recourse may be had to frequent lavage and nourishment *per rectum*. Rectal alimentation should be preceded by irrigation of the bowel with a warm boric-acid solution. The nutrient enema should be rich in nitrogenous substances. Most of the much-advertised beef-preparations are comparatively useless as well as expensive, and better results are obtained from the use of eggs and milk. The injection advised by Ewald is admirable. It consists of two or three eggs, whipped up in a little thin gruel, to which is added a small amount of glucose. It is frequently necessary, especially when the method is long continued, to employ a suppository or a small enema containing opium, together with starch-water and some vegetable astringent. It is more satisfactory to introduce the enema through a soft-rubber tube carried to the sigmoid flexure. Undoubtedly many cases of dilatation of the stomach are best treated by surgical procedure. In case of carcinoma of the pylorus, gastro-enterostomy should be established, and in case of non-malignant stricture of the pylorus the operation for enlarging the opening, either Loreta's or, preferably, that proposed by Heinecke, should be performed. Einhorn reports the disappearance of the dilatation after the latter operation. When there is a patulous pylorus, associated with extreme dilatation, there would seem to be a field for the operation recommended by Weir and others and which consists in folding the lower portion of the stomach upon itself, stitching it in place, and thus doing away with the large sac in which the food accumulates.

**Carcinoma of the Stomach.**—The problem of the treatment of gastrectasis is too often bound up with the history of carcinoma, and the most favorable results in the treatment of the latter affection are the tiding over of some crisis, the lessening of suffering, and the prolongation of life. The great frequency of gastric carcinoma leads to the greatest apprehensions on the part of many patients suffering from relatively harmless affections, and for this reason the physician is inspired to do his utmost to make the clearest diagnosis pos-

sible, and when doubt exists it is best to assume that the case is not malignant. In not a small proportion of cases it is unsafe during the early period of the disease to hold more than a suspicion of the presence of carcinoma, and occasionally the difficulty in diagnosis continues until the fatal termination approaches.

As there exists no pathognomonic symptom, and as the available data may be accounted for by other conditions, the wise man will be satisfied to suspect, while laboring to improve the situation. In the beginning the more or less prolonged stage of indigestion is characterized by poor secretion and absorption and, usually, disturbed motion. There is a depreciation of the peptic ferment as well as of hydrochloric acid; lactic acid is generally encountered; and, unless the exaggerated motility hurries the stomach-contents through the pylorus, food-stagnation occurs. Unless there is marked obstruction the active motility is favorable, in that it permits the patient to maintain a fair degree of nutrition by means of intestinal digestion and absorption; on the other hand, it proves a source of distress by setting up annoying eructations of gas and stomach-contents. Occasionally there are periods of continual nausea, varied by attacks of vomiting. Pain is not usually present until ulceration occurs, and then it is less common than is generally supposed. In the later stages one has to deal with almost complete suppression of gastric secretion, and absorption seems to be even more interfered with. After precise study of the stomach-contents in many cases I have in only one found free hydrochloric acid present at an advanced stage of carcinoma, and in so far my experience confirms Riegel's original statement. That a small proportion of the acid is secreted in the presence of albuminoid food I have no doubt, as one commonly finds present peptone and propeptone, and at times in large amounts—an evidence not of rapid peptonization but of impaired absorption. The combined chlorids are also frequently present, and constitute evidence that gastric secretion is not absolutely abolished. These facts are suggestive as to therapeutics, and point out the fallacy of introducing liberal amounts of peptonized foods into an organ whose resorptive functions are lost. Lactic acid is usually present in gastric carcinoma. Even when the food taken is free from preformed lactic acid, the latter may be found constantly present. That it is occasionally absent I am sure, as it was not found in two of my cases that submitted to exploratory incision, thus rendering the diagnosis of carcinoma positive. The discovery of lactic acid as a constant constituent of the gastric contents when the food is restricted to oatmeal-gruel, a substance free from lactic acid, possesses some diagnostic value. It is not, however, conclusive. The abundance of organic acids of all kinds that appear in carcinomatous stomachs offers to the physician serious trouble in directing a diet.

As an addition to the therapeutic problem must be considered dilatation, food-stagnation, fermentation, gastrorrhagia, vomiting, and pain. The last-named symptom apparently depends partly upon ulceration, partly upon pressure and probably perineuritis.

The medical treatment of carcinoma in its early stages will, so far as the

stomach is concerned, content itself with the management of the indigestion by the methods hitherto described in speaking of the functional disorders of the stomach. In most cases, large doses of bismuth and of cerium oxalate at night will prove beneficial, while pepsin and hydrochloric acid in liberal doses should be administered after meals. Occasionally the bitter infusions, such as gentian and chiretta, administered before eating, are of benefit. The best of the class is one that in the United States is rarely mentioned save with opprobrium, and that is condurango. It is unquestionably of benefit to digestion and agrees well with the stomach, even in advanced cases of gastric catarrh, but the idea that it has any specific effect upon the disease is abandoned save by a very few Continental observers. Half a wineglassful of the infusion made from an ounce of the bark in a pint of water, or teaspoonful-doses of the fluid extract, should be given before meals. In most cases arsenic is of positive benefit in its influence both upon digestion and upon cellular nutrition. By its effect the proportion of urea, which, as Rommelaere long ago pointed out, is greatly diminished in this disease, rises appreciably and there is sometimes a positive gain in weight. For the gastric distress and unrest so often present benefit may be had from the frequent administration of chloroform-water; or, when its depressing effects are not too objectionable, small and frequent doses of chloral are of service.

There is a marked difference as to the effects of sedatives. In some cases drop-doses of carbolic acid, alone or combined with one-fourth grain (0.016) of cocain hydrochlorate, often best given in cherry-laurel water, prove useful. After lavage, the local application of a bismuth-mixture or a spray of menthol rarely fails to give temporary relief. The foregoing measures are frequently sufficient to control the vomiting and sometimes even to relieve pain. The continued disagreeable taste, sometimes with dryness of the mouth, beginning with increased salivation, is at times well met by using purified creosote or creosote carbonate. Very soon all remedies having a positive flavor become disgusting to the patient.

As for the *diet*, in the early weeks of the disease it is sometimes found advisable to omit the albuminoids, while reinforcing the digestion by thoroughly cooking the starches and giving malt or pancreatin. As a rule, all fruit-juices disagree. Exceptionally, lemon-juice, lime-juice, and grape-juice are acceptable; this is usually when albuminoids are permitted—an allowance, as a rule, necessary at times, as these patients abhor the restriction in diet and soon crave most those foods that are denied. As the disease progresses, the physician finds little to be gained by insistence on a dietary, and leaves the patient somewhat to his own experience as to the changes that are made from day to day—almost from hour to hour. Alcohol is sometimes absorbed more quickly than other substances. Whisky and cognac are the most satisfactory forms, particularly when depression calls for the prolonged use of stimulants. Fermented liquor and all beverages containing carbonic acid are usually not tolerated, and this is especially true when dilatation exists. Under other circumstances plain soda-water or an effervescent water is sometimes most grateful to the patient.

Champagne is rarely desired after a trial of a day or two. Many times the only food tolerated is milk with hydrochloric acid. It is best to combine the milk with a portion of water with which the acid has been previously mixed. Peptonized milk, matzoon, kefyr, koumiss, milk with lime-water or carbonated water, Vichy, or Apollinaris water should be tried. In the later stages the physician may continue the methods named within the limitations of the case, while giving attention to the more urgent symptoms arising from obstruction, dilatation, gastrorrhagia, or pain. When food-stagnation is marked and when there is present the continued discharge of a watery serum into the stomach, lavage at night becomes necessary.

It is pitiable to see the suffering of patients to whom the relief afforded by lavage is not allowed. The slight discomfort of passing the stomach-tube proves no deterrent to most patients who have once experienced the relief. There is little danger of provoking hematemesis if the soft tube is employed, and even should this occur it is usually an incident of little import. Occasionally the hemorrhage is severe, particularly when there coexists hepatic cirrhosis. The advent of hemorrhage at any time may be met by the swallowing of ice and by the application of cold to the epigastrium. The administration of astringents or of ergot is to be deprecated, and the subcutaneous injection of the latter agent proves of little benefit in the gastrorrhagia of carcinoma. Besides the use of ice, the physician may content himself with a hypodermic injection of morphin, thus securing physiologic rest. As for pain, there is but one remedy that is worthy of much consideration, and that is some preparation of opium. When its constipating effects are not objectionable the old opium-pill is satisfactory, but codein is less likely to cause constipation and is in every way to be commended.

As for the gastric catarrh that frequently accompanies carcinoma, but little can be done save by lavage. The spray of the 1 : 500 solution of silver nitrate after lavage is to be recommended. Vegetable laxatives, aloes, compound licorice-powder, and cascara sagrada with calomel must be given occasionally. This consideration is important, as toxemia has much to do in carcinoma with the lowering of nutrition and consequent depression.

It will be found that the general treatment of carcinoma, no matter where located, should include measures favoring elimination. Besides the regular attention to the intestinal tract, frequent and profuse diaphoresis should be ensured by the hot-air bath. These methods will postpone emaciation and assist materially in maintaining the digestive functions. Rectal alimentation may be necessary in view of prolonged vomiting, gastrorrhagia, and complete food-stagnation. The plan advocated in speaking of gastrectasis should be followed.

Pyloric carcinoma, leading to early obstruction, should be treated surgically. If pylorectomy is deemed inadvisable, gastro-enterostomy should be effected. By this resort the general health is improved, and the torture of food-stagnation is prevented. One of my cases gained forty pounds in weight in eleven weeks' time following gastro-enterostomy.

**Erosions of the Stomach.**—A condition of the gastric mucosa that was brought to notice only when precise examination of the stomach-contents became a familiar matter, and that was first clearly stated in literature by Einhorn, is that of erosion. Its presence may be recognized by the frequent appearance in the stomach-contents of fragments of the mucosa, sometimes including portions of the submucosa, which, in microscopic sections, show a distinct structure still remaining. That these fragments do not result from injury induced by passing the stomach-tube is demonstrated by their more or less continued presence even when the tubes are passed without retching on the part of the patient, or without other violence. Besides this, I have observed evidences of the oozing of blood, which is present in but small quantities, and never amounting to a hemorrhage. The observation has been made in several cases of anacidity, and the distinction from round ulcer is established by the absence of the other cardinal symptoms of that affection. Erosions of the stomach are attended with disturbed or much retarded digestion and are prone to be chronic. Relief follows a diet restricted to milk and sometimes gruels with malt, and the frequent practice of lavage, followed by irrigation of the stomach with mild astringents, among which a solution of silver nitrate in the strength of half a grain (0.032) to the ounce (30.) is most serviceable.

I can speak favorably of Einhorn's recommendation to spray the empty stomach with a solution of menthol of from 5 to 20 grains (0.32–1.3) to the ounce (30.) of liquid vaselin.

**Gastric Ulceration.**—Not all ulcerations of the gastric walls are identical with the peptic ulcer or round ulcer of Cruveilhier. As the presence of ulceration can in many instances only be suspected when profuse hematemesis appears, it follows that the diagnosis is often not made. Besides the absence of hemorrhage, the other cardinal symptoms, localized pain and tenderness, are occasionally wanting, and it is said that even hyperchlorhydria is in rare instances not present. If true, this must be very exceptional. I have never found hyperchlorhydria absent. As rational therapeutics should be based upon etiology, it would be a great advantage if we knew the precise cause of this often recurrent affection. Of the various theories advanced none seems to me to satisfy the conditions so well as the view that peptic ulcer is a manifestation of a neurosis, and that the digestion of sharply defined, circumscribed, and peculiarly located portions of the gastric walls arises from interrupted circulation in the diseased parts following vaso-motor spasm.

The treatment of peptic ulcer is too often delayed until the occurrence of the tragic events, hematemesis and collapse. With very rare exceptions, these unfortunate symptoms are preceded by a period of gastric distress and painful digestion that call for a thorough examination, including that of the chemistry of the gastric contents. The indications thus afforded, while they may not always signify beyond doubt the presence of ulcer, make sufficiently clear the treatment that should be pursued, and if this is properly carried out improvement will be immediate and the more serious symptoms avoided. The truth of this statement is witnessed in the results of the treatment of reappear-

ances of the disease subsequent to an attack in which profuse gastrorrhagia has taken place. This treatment is in many respects like that already prescribed for hyperchlorhydria; that is, the patient should have a diet the least likely to excite gastric activity, and should have remedies that soothe the gastric mucous membrane and lessen the acidity of the secretions. Besides, it is usually wise to remove the patient from active mental or bodily exertion and to restore tone to the nervous system by hydrotherapy. Sleep should be encouraged, if necessary by hypnotics, and, usually, after a few days the use of remedies looking toward the improvement of the blood, like the non-acid preparations of iron, may be instituted. Meanwhile the gastric sedatives already described, or lime-water, sodium bicarbonate, prepared chalk, the light calcined magnesia, or strontium bromid should be continued at frequent intervals. One sometimes suits better than the other, and a combination may be more fortunate than one drug alone. These measures will control pain and vomiting, as both of these depend upon the irritation caused by the intensely active gastric secretion. It is usually unnecessary to administer opium if the treatment is in other respects correct. Although pain is commonly induced by eating, this will not prove to be the case if peptonized milk and lime-water be given very frequently, preceded and if necessary followed by the antacid drugs already mentioned. In fact, if the gastric secretions are kept sufficiently busy in the digestion of milk, there will be little irritation at the seat of the ulcer. It is true that in some instances there is a severe gastralgia set up when anything is taken into the stomach, and the localized tenderness is also made worse. The pain reaching to the back or through the chest may be so severe as to lead the patient to avoid the taking of nourishment of any kind. In such cases it would be folly to withhold opiates, and the effect of morphin or codein is admirable in relieving these as well as most other symptoms belonging to the affection. The objection is the danger of acquiring the opium-habit and also the disturbance of the nervous system to such an extent that real progress is impossible. The clever physician will therefore reserve his opium for the more painful cases, or for those in which hematemesis occurs.

The internal administration of ice is not advised, as ice rather increases than lessens gastric secretion. Although cognizant of the benefit that occasionally follows a diet of ice-cream, the fact remains that, as a rule, the use of ice should be limited to external applications. The question of lavage in gastric ulcer often arises. Generally it is uncalled for, and occasionally it is harmful. In exceptional instances greater relief is afforded by lavage with warm alkaline fluids followed by the thorough application of an emulsion of bismuth than by any other measure. This should be done late at night, with the hope that rest for the stomach may thus be secured. Many special remedies have been suggested for the affection that have, so far as I know, small reason for their adoption. Potassium iodid, silver nitrate, resorcin, and bismuth salicylate are among the number. These remedies held a place before modern methods of dealing with the stomach had secured a place. Doubtless all of them are occasionally capable of relieving symptoms, but, when one views the pathology of

gastric ulcer as it exists to-day, confidence in such remedies becomes small. Perhaps the most useful of the group is resorcin, although this remedy is more serviceable in the treatment of other forms of ulcer not attended with high digestive activity. More can be said in favor of the bromids, particularly the salts of strontium and sodium. If employed, they should be given in large and repeated doses, combined with remedies more positively alkaline, and with the diet already described. When, owing to idiosyncrasy, this diet is impossible, one must resort to some of the various forms of pap or gruel. It may be well to combine with these extract of malt. The preparation known as "malted milk" often serves well when milk alone is objectionable. Sometimes, when marked improvement has taken place, it is possible to put the patient upon a strictly albuminoid diet, directing that the meals be frequent and that the gastric juice be diluted by large potations of warm water. The object of this plan is to allow the rapid digestion of meat, hoping that by the formation of acid salts the free hydrochloric acid may be disposed of and the stomach-contents thus rendered less irritating. This plan occasionally works well, but the patient should be seen often and should be instructed to report at once if gastric distress appears.

As in case of hyperchlorhydria, it is important to have the intestinal tract open, for which purpose an occasional mercurial, and frequent drafts of saline solutions should be employed.

With the appearance of hematemesis the method of treatment is somewhat different. The patient should be kept absolutely still, to which end a quiet room, a single attendant, and the frequent employment of morphin hypodermically should be directed. An ice-bladder should be kept constantly over the epigastrium, and full doses of the aqueous extract of ergot should be introduced subcutaneously. Nourishment should be administered by the rectum alone. In case of thirst, a pint of warm water may from time to time be introduced into the rectum. It is wisest not to thus increase the bulk of the blood until some hours after all evidences of bleeding have ceased. When two or three days have elapsed without vomiting and when the patient is rallying from the shock, it is admissible to introduce bismuth or the "gastric sedative" mentioned on a preceding page, stirred up in a little warm water, at such intervals as seem indicated, and thereafter the patient may take not too cold water by the stomach. A week should have elapsed before nourishment is allowed in the natural way. Henceforth the case should be treated as already described. It is not because so many patients die from gastrorrhagia that one dreads its appearance in round ulcer, but because the profound depression following it makes reparative processes slow and therefore exposes the patient to greater danger from perforation, or from pyloric stenosis resulting from extensive cicatrization. When such stenosis has occurred as a consequence of foregoing attacks and the physician has to deal with a resulting dilatation and an active ulcer, lavage, in spite of the objections to it in such cases, becomes a necessity. After the ulcer is presumably healed the patient should take iron and arsenic for a long period, in conjunction

with applications of the "cold wet-sheet," the cold spinal douche, massage, general faradization, and any promising change in climate, hoping thereby to restore richness to the blood and energy to the exhausted system. The patient should be directed to report upon the reappearance of the slightest gastric disturbance or when evidences of anemia or depression manifest themselves.

**Duodenal Ulcer.**—The management of round ulcer of the esophagus should be along the same lines as that of gastric ulcer. Duodenal ulcer should, on the other hand, receive somewhat different treatment. Although less frequent than gastric ulcer, it is more intractable to treatment and more often fatal. Elaborate measures should be employed to secure its early healing, both to obviate possible hemorrhage or perforation and to keep within a minimum the resulting cicatrization. The plan of treatment has for its object the securing of the longest rest possible for the duodenum. This is accomplished by allowing but one meal a day and limiting that to substances that induce least irritation. Generally, this will be found to consist in milk and farinaceous foods, as they excite less gastric secretion, and the chyme that passes the pylorus will thereby be rendered less irritating than when albuminoids make up the bulk of the diet. The single meal should be given at mid-day and thorough lavage should be practised at night, so that local irritation of the ulcer may be reduced to a minimum. Generally, there is excessive acidity of the gastric contents in case of duodenal ulcer, and this should be neutralized by large and frequent doses of alkalies and gastric sedatives. When the ulcer is active and when hemorrhage has occurred, it is best to give the part complete physiologic rest by resorting to rectal alimentation and opium in full doses, keeping the patient perfectly quiet. In spite of all efforts, there is frequently very much suffering and no little courage is needed on the part of the patient to enable him to submit to the long-continued abstinence from eating and to the complete quiet that is necessary. The general management of the case should be the same as that in case of gastric ulcer.

**Inflammatory Conditions of the Stomach.**—Much confusion exists regarding the nature of the inflammatory states of the gastric parietes, owing to the conception that the gastric mucosa is like other mucous membranes. While it is true that the epithelium lining the stomach and the specific glands are, under certain conditions, capable of discharging large quantities of mucus, it should be remembered that the mucosa and, for a great part, the submucosa are made up of glandular structure, and the inflammation of the lining of the stomach differs, therefore, materially from inflammation of other mucous surfaces. So, when the inner surface of the stomach is inflamed, we have to deal with a mixed condition that is partly a catarrhal inflammation and partly an adenitis. It, therefore, seems proper to speak of these various inflammatory conditions as varieties of catarrhal gastritis, a nomenclature that has received just criticism, and yet one that more nearly describes the pathology than any other.

*Acute Catarrhal Gastritis.*—This condition exists either as a febrile or as an afebrile state; or, as some describe it, as an acute or a subacute catarrhal

gastritis. The former of these may be a serious affection in children and in delicate individuals, but, although it presents a train of distressing symptoms, it is not often a fatal disease in vigorous adults. Its severity depends largely upon the cause, and its treatment is to some extent modified by the same fact. For instance, a case dependent upon overtaxing of the stomach with large quantities of irritating and undigestible food is not to be managed precisely in the same way as one following an alcoholic debauch. It should be remembered that there always exist accompanying irritation and congestion of the liver, with marked disturbance of the functions of that organ, and the intestinal tract is similarly disturbed. Undoubtedly, bacteria and toxins of bacterial origin are largely responsible for the inflammatory state and for the severe toxemia often present. Probably, the fever, the disordered secretions, and the nervous phenomena largely owe their origin to the toxemia. Perhaps the local symptoms—tenderness, gastric distress, pain, nausea, vomiting, anorexia, and heavily coated tongue—depend somewhat upon the general, although for the most part upon the local, conditions.

With this conception of the disease, the line of treatment seems self-evident. To begin with, the natural efforts toward elimination should be encouraged, and even when the vomiting and diarrhea are active it is usually wise to secure a thorough emptying of the alimentary canal, either by the stomach-tube or by an emetic, and by the administration of full doses of calomel. The drinking of from two to four glassfuls of warm water may suffice to cleanse the stomach without resort to the emetic or lavage. The full dose of calomel should rarely if ever be omitted. It not only acts to unload the portal circulation and hence relieves the liver of an unnecessary task, but, besides, it secures the thorough emptying of the intestines and at the same time exercises an excellent antiseptic effect. When the stomach relieves itself through vomiting, the first food returned shows no effect of digestion, and not until the later efforts bring out small portions of yellowish or greenish fluid, bitter from peptones, do we find any vestige of past functional activity. This fluid is usually acrid and irritating, and if it passes into the intestines is likely to give rise to borborygmus, flatulence, and diarrhea. Again, notwithstanding medication, and in spite of intestinal irritation, no evacuations occur, and under such conditions it is a mistake to wait too long for the action of the calomel. It is wiser to repeat the dose of 10 grains (0.65) after the lapse of four or five hours, and follow with a Seidlitz powder, Rochelle salts, or Hunyadi water. In few cases a single large dose of castor-oil is better retained and is more effectual than salines. Finally, an enema of a saturated boric-acid solution or a solution of creolin, a teaspoonful to a quart of water, should be introduced in sufficient amount to thoroughly empty the colon. In any event, the physician should not rest satisfied until he is sure that the digestive tract is thoroughly empty. At this point the patient is usually much benefited by a warm tub-bath. In mild cases this, with complete rest in bed and abstinence from all foods for from twenty-four to forty-eight hours, is all that is necessary. More often there remain gastric irritation and febrile disturbance, which require attention, and both of

which yield to the administration of small doses of morphin hypodermically and the application of light poultices, spongiopiline saturated with spiced alcohol, or flannels wrung out of hot water and covered with rubber dam. Rest for the stomach is generally more useful than the administration of any drug at this time. Occasionally bismuth, cerium, and cherry-laurel water prove grateful and the swallowing of shaved ice may be permitted. When vomiting is persistent, an increase of the anodyne is indicated; and when an idiosyncrasy exists against opium, a clyster of chloral, with perhaps cannabis indica, may be substituted. If the febrile movement is active and attended with malaise and headache, subcutaneous or rectal injections of antipyrin should be directed. The error is generally made of allowing the patient to eat too soon. Food should be forbidden until the patient craves it and then it should be given in small quantities and be of the blandest kind.

*Subacute Catarrhal Gastritis.*—In the afebrile form of this affection the treatment is quite similar to that detailed for acute catarrhal gastritis, save that the constitutional treatment may be omitted or modified according to the indications. The same careful attention should be given to this disorder, for if of less immediate severity it is quite likely to continue as a chronic gastric catarrh, or to invite the occurrence of some of the functional gastric disorders that may have been awaiting an opportunity. When the symptoms continue beyond a reasonable lapse of time it is recommended that a search be made for something besides a transient accidental cause for the condition. Often there will be found to exist a kidney-defect, or toxemia of intestinal or hepatic origin, marked anemia, or some reflex nervous cause.

*Symptomatic Gastritis.*—This term is used to describe the form of gastritis that is commonly one of the expressions of some of the general infectious diseases. By the Germans it is called sympathetic gastritis, and is commonly observed in connection with scarlatina, rubeola, variola, and particularly in children with catarrhal pneumonia and bronchitis. Its morbid anatomy and clinical history resemble those of other forms of acute gastritis. It is sometimes the most dangerous expression of the determining affection, although doubtless some of the symptoms are the result of the toxemia operating upon the nervous system. So far as compatible with the management of the specific disease, the stomach-symptoms should be treated as in dealing with simple gastritis. When prostration demands the administration of alcohol, the situation often brings serious embarrassment. If possible, alcohol should be kept from the stomach, but when its use is unavoidable champagne should be selected, or very old whisky given in a mucilage of almond or althea. It is a mistake to suppose that gastric digestion fails in all infectious fevers. In not a few instances of typhoid and other fevers the gastric digestion is fairly well maintained. It may then be assumed that there exists little or no gastritis, for with inflammation of the peptic glands there is a suppression of normal gastric juice, even when there is poured out abundant watery and mucous secretion. He is a wise man who knows how to manage the diet in these infections when gastritis is present. On the one hand, an abundance of fluid food is demanded,

while, on the other, there exists an inability to digest this. In such a dilemma it is wiser not to give foods. In these days, the tendency exists to over-feed rather than to under-feed fever-patients of all kinds. To rest the stomach intermittently is good practice, and this recourse should not be postponed until the symptoms are so aggravated that prolonged rectal alimentation is required.

*Toxic Gastritis; Gastritis following Chemic Irritation or Destruction; Traumatic Gastritis.*—The ingestion of scalding liquids, powerful acids, alkalies, and escharotics is followed by inflammations varying from superficial injury of the mucosa to destruction of the deeper layers of the gastric walls. The character of the inflammation is influenced not only by the amount, but also by the character, of the irritant; hence the condition succeeding the introduction of pure alcohol differs from that resulting from acids, alkalies, arsenic, phosphorus, etc. The difference in the condition calls for a difference in treatment. In all cases it is necessary to empty the stomach immediately, and when there is not too much damage to the pharynx and esophagus it is better to introduce a soft stomach-tube than to depend upon an emetic. There are exceptions to this rule; as, for instance, when the poison is taken immediately after a meal, as the stomach-tube is unsuccessful at such a time. An emetic generally succeeds best when the stomach is full, and the stomach-tube when the viscus is relatively free from solid matter. To secure free emesis it is best to employ a full dose of apomorphin hypodermically and to assist its action by large drafts of warm water. No delay in emptying the stomach should be permitted, and, if the emetic is not prompt in its action, the mere introduction of the stomach-tube will probably excite vomiting. While preparing to empty the stomach, some form of alkali, like magnesium carbonate, should be freely administered after the introduction of acids and escharotics, while vinegar, lemon-juice, or acid wine may be given when alkalies have been swallowed. The demulcents are always of use, and large quantities of albumin should be taken after the swallowing of corrosives of any kind.

The subsequent behavior of cases is so variable that no single line of treatment can be directed. When shock exists, nourishment and alcohol should be given *per rectum* and morphin under the skin, while heat and friction should be applied generally except over the epigastrium. Bismuth, in an infusion of poppy-seed or some similar demulcent, may be administered frequently if it affords relief. The same may be said of shaved ice. In other respects the stomach should be permitted to enjoy absolute rest. Days and even weeks may elapse before food can be safely permitted. As stated in speaking of simple gastritis, the return of appetite is usually the best guide. Whether or not inebriates have gone upon a drinking debauch and have taken excessive amounts of distilled liquor, we have to deal with a form of gastritis partly from local irritation and partly from constitutional causes. When such excesses have been frequent, the stomach becomes thickened, its walls infiltrated with round cells; there is suppression of the normal secretions and there is a large discharge of mucus and pituitous matter sometimes with hemorrhage.

In association with these there are likely to occur the other well-known phenomena of chronic alcoholism, including profound nervous phenomena. Such cases are very serious, and undoubtedly death often occurs as the direct result of the stomach-condition. They are best treated by the methods already described, together with such other measures as the general condition may demand.

In the afebrile gastritis of the inebriate, one has to deal with a milder affection that usually subsides under the frequent use of calomel and magnesium sulphate, together with the complete withdrawal of alcohol, perfect rest of the stomach, and rectal alimentation and medication. Generally, large doses of chloral thus administered will be necessary and will affect as favorably the gastric as they do the other symptoms. In the morning vomiting of drunkards in which there occurs the ejection of quantities of mucus and of alkaline fluids, after which the victim is enabled to retain his morning dram and subsequently a small amount of food, it is necessary to prohibit the use of alcohol abruptly, and this usually serves to relieve the gastric symptoms at once. Benefit appears to follow the administration of drop-doses of Fowler's solution. Good effects sometimes follow the use of a few drops of the tincture of capsicum, and quinin is often of value. Nearly all such cases are improved by taking, some time before breakfast, large drafts of the saline purgative waters, of which Hathorn and Carlsbad are good examples. The amount should be sufficient to ensure free evacuation of the bowels. In the absence of these, sodium or magnesium sulphate taken in an abundance of warm water may be substituted. Very often the condition of digestion in the morning will be benefited by regularly administering at night a mixture containing one part of ammonium chlorid, three parts of sodium bromid, and twelve parts of magnesium sulphate; but after all the best cure for drunkard's stomach is abstinence from alcohol, and when this cannot be brought about permanently, even a temporary stay of proceedings is of great value.

*Chronic Catarrhal Gastritis.*—This is generally if not always a secondary affection, and follows rather than precedes the numerous functional, as well as most of the structural, disturbances with which it is sometimes associated. It is true that, when once established, chronic catarrhal gastritis may give rise to depression or disappearance of functional activity, and that many of the symptoms that attend it are identical with those that occur in simple functional disorders. This statement seems necessary, as the tendency exists among writers to ascribe to so-called chronic gastric catarrh the origin of those functional disturbances that are described in these pages as having a far different etiology.

Chronic catarrhal gastritis rarely results from overtaxing of the stomach alone, but, as has been said, it is secondary to other diseases. Cardiac, pulmonary or hepatic diseases producing congestion of the stomach are among the most frequent causes. The condition is commonly associated with renal disease and accompanies the continued toxemia and anemia of tuberculosis, syphilis, and pyemia. When from any cause the general nutrition is greatly lowered—particularly when the appetite is out of proportion to the digestive

strength; or when, to satisfy cravings for special tastes, certain indigestible foods make up the bulk of the diet; or when, hoping thereby to improve the general health, the physician is tempted into forced feeding—chronic catarrhal gastritis is the natural result. The acidity of the gastric juice is lowered or abolished, or, if it be in excess, it will be found to depend upon the organic acids. It is possible for marked fermentation or even putrefaction of the stomach-contents to take place, and this is particularly true when gastrectasis, with food-stagnation, is present. The movements of the stomach are quite generally feeble, and inactivity of the liver and intestines will usually be found.

Many have based the diagnosis of chronic catarrhal gastritis upon the appearance of an abundance of mucus after the use of the stomach-tube, or when vomiting has occurred. It is true that there is an excess of mucus in the stomach, but most of that seen in the stomach-contents obtained with the tube comes from the pharynx and esophagus. Practice enables one to distinguish with a reasonable degree of certainty between esophageal and gastric mucus. The abundant, glairy, ropy, and almost transparent mucus that pours out around the stomach-tube, or even through the tube, having previously passed into the stomach, has its origin in the esophageal mucous membrane. That from the stomach separates more readily, is sometimes of whitish color, and frequently has a shreddy, patchy appearance. At times it is secreted in great abundance and resembles imperfectly dissolved tapioca.

With these preliminaries, the treatment of this important condition may be approached with greater confidence. In the beginning, every effort should be made to remove the etiologic factors. Digitalis, strychnin, rest in bed with massage, are to be applied when cardiac or pulmonary disease gives rise to venous obstruction, and calomel, gray powder, or green mercurous iodid should be advised, and followed by daily drafts of saline solutions, of which sodium sulphate and phosphate, and Rochelle salts or Carlsbad or Hunyadi water are first to be considered. A more active life should be required of the patient suffering from hepatic trouble, but the increased exercise should be gradually brought about, as bodily activity is attended with increased tissue-waste, and a bilious attack may easily be precipitated by the sudden adoption of an active life. The object to be attained is improved oxygenation, with increase of the activity of the capillary circulation and the hurrying of the lymph-stream. These requisites can usually be obtained with most satisfaction by subjecting the patient to a combination of hydriatric treatment and moderate physical exercise. The Turkish bath, properly given, is of great value, but too often, owing to ignorant attendants, it leads to exhaustion rather than benefit. A brief cold shower-bath or needle-bath, followed by brisk friction, with rest in bed afterward, is a measure of great importance. The error is commonly made of continuing the bath too long at first, so that there results depression of the nervous system and a worse rather than a better condition of the hepatic functions. The application of a cold pack over the liver is of real use as an hepatic stimulant when it can be intelligently directed and its immediate effects

observed. The cold and wet sheet is another measure not to be forgotten, but it should be applied only by an experienced person.

The application of cups or leeches over the hepatic region, and counter-irritation, have fallen into pretty general disuse. Very often we find patients prescribing for themselves plasters from which they claim to receive benefit. There is probably truth in the conclusion reached by the old therapeutists as to the benefits attending such measures of treatment; particularly in hepatic cirrhosis, when inosculations of the portal and systemic veins have become established, local depletion by leeches or cupping, under certain conditions, seems indicated. The urine should be studied, and when large amounts of indican are present, and particularly when the alvine evacuations are lacking in color or are offensive, it is advisable to employ enteroclysis, with a view to cleansing the bowel, and hot lavements two or three times a week have seemed to me of great value. The importance of appreciating the state of the liver has seemed to justify the space here given to it. With the presence of toxemia from renal failure, hot vapor-baths should be used with frequency until the condition of the blood is improved and the function of the liver has been at least partially restored. When it does not disagree with the stomach, an abundance of pure well-aerated water should be taken.

If specific disease is present, let it receive appropriate treatment.

In case of advanced anemia, its relief should be attempted without too much dependence upon the ferruginous preparations. There are times when iron may be employed with great benefit, but its routine administration is probably undesirable in the condition under consideration. The end can be reached more easily by hygienic measures, together with local treatment of the stomach. The latter measure is scarcely to be omitted in a case of established chronic catarrhal gastritis. Daily lavage should be directed, and it should be practised by a person expert in the use of the tube, so that frequent observations can be made as to the motor activity, as well as to the gastric chemistry. In this way also the diet that best suits the case can be ascertained, for it is a well-known fact that great differences exist as to the most suitable foods in given cases. It is not for these observations alone that lavage is indicated, but because of the opportunity it affords of clearing the stomach of irritating contents, of applying to its mucosa remedial agents, and of making it possible for the stomach to enjoy rest under the best possible conditions. It is desirable to have the heartiest meal ordered for the middle of the day, and then to wash out the stomach at bed-time, thus ensuring for the part complete inactivity through the night, and breakfast should be delayed on the following morning as late as possible. Another plan is to give the heartiest meal at six in the afternoon, to practise lavage early in the morning, and to make the patient fast for several hours thereafter. The former plan will usually be selected. A weak saline solution, or a solution of boric acid, is advisable for the lavage, and following this the 1 : 1000 solution of silver nitrate may be introduced and immediately removed from the stomach; or a mixture of two or three teaspoonfuls of the fluid extract of hydrastis with a pint of water, or a like

amount of the extract of hamamelis may be used. These local measures, if persistently carried out, in addition to such general treatment as the case may demand, will afford the most satisfactory results unless the condition depends upon some irremediable disease, when relief will of course be all that can be expected.

The *diet* in chronic catarrhal gastritis must, as stated, be varied considerably to suit the individual case. These general rules can be laid down: All overstimulating, coarse, and irritating foods should be prohibited. Unbolted flours, coarse meals and grits, as for instance oatmeal, are unsuitable; and barley, rice, and sago should be used only when so thoroughly cooked that the grains easily fall to pieces. Very little fruit is permissible, and none that contains seeds. But little fat should be allowed, as it gives rise to the formation of distressing acids, and all foods blended with fats, particularly before cooking, are objectionable. The tenderest meats, uncooked or soft eggs, very thoroughly cooked starches, with perhaps the addition of malted milk, are to be selected. Hot or cold milk, especially peptonized with extract of pancreas or partly changed by the action of rennet, or blended with lime-water, Vichy, Apollinaris, or with the addition of a weak solution of hydrochloric acid, may become the chief article of diet in all severe cases when the troublesome persistence of lactic-acid fermentation does not countermand it. One should not forget the benefit derived from koumiss, matzoon, and like preparations, with of course the same exceptions regarding lactic acid. Tea, coffee, and cocoa are not necessarily excluded. Chocolate should be left off the list. Light wine is sometimes of real benefit, although in most cases all alcoholic beverages are best omitted, as is true also of tea and coffee in certain proportions.

*Phlegmonous Gastritis.*—This rare and dangerous form of gastritis is essentially a cellulitis of the walls of the stomach, and is often, if not always, the result of bacterial invasion. It is found in the muscular layers, but may involve the mucous and the serous layers as well. It is attended with fever, shock, pain, and tenderness, sometimes with hematemesis, and often with peritonitis. Its treatment is expectant and symptomatic; that is to say, it includes rest, opium, abstinence from food, with warm or cold baths.

*Atrophy of the Gastric Mucosa.*—In prolonged atony, at times in advanced dilatation, atrophy of the muscular layers of the stomach is found. It is more common to find such muscular atrophy accompanying neuritis and the infections, and in those chronic diseases in which nutrition falls to the lowest ebb. Similar causes may lead to the more specific trouble under consideration, namely, atrophy of the gastric mucous membrane. This condition has been described in literature as, and to some extent is still considered to be, a special disease, and has been recognized as the cause, in some instances, of emaciation and pernicious anemia. We now know that such a conclusion is at least doubtful, as patients in whom the gastric mucous membrane remains for an indefinite period almost functionless are at times able to maintain a fair state of nutrition by means of intestinal digestion. In speaking of anacidity it was shown that suppression of the normal gastric secretions came about from neuropathic causes,

and that the long-continued depression of the gastric functions resulted, as do such influences in other organs, in atrophy of the parenchyma. It seems highly probable that most cases of atrophy of the peptic glands follow continued functional disorders, and that the exceptions occur in those instances of acute and chronic disease in which the stomach suffers in company with other organs; and in long-continued catarrhal gastritis it would be natural to expect gastric atrophy. While this association does exist, yet it is not so frequent as might be expected; and, when present, the atrophy is as likely to precede the gastritis as the gastritis the atrophy. The treatment of atrophy of the stomach should be practically the same as that of gastric anacidity, as already described. The results of long-continued regulation of the diet, together with intragastric faradization and galvanization, are sometimes unexpectedly gratifying. There are likely to remain patches of mucous membrane that are relatively intact, and these, under proper treatment, regain the powers lost from long functional inactivity, so that the stomach may again become fairly useful. When the muscular activity is not too much weakened, atrophy of the gastric mucosa is not such a serious condition as we have been led to believe, as the stomach may play the rôle of the crop of the fowl, pressing its contents through the pyloric ring, so that the intestines may assume with fair success the responsibilities of digestion and assimilation. If these principles are thoroughly understood, it will not be necessary to lay down specific rules for treatment. It will at once be seen that the electric treatment will be useful in improving the motor activity, even if it fails to restore secretion. The influence of the nervous system upon the motions of the stomach must be kept in mind. I have one patient who for years has had no gastric secretion, and who is unable to empty her stomach satisfactorily, and therefore becomes emaciated, save during pregnancy. At the beginning of gestation the gastric motility returns, the appetite is good, the food-substances pass into the intestine, and there is an immediate gain in flesh and vigor. Three times this has been repeated under my observation. The case is suggestive, and invites one to put forth every effort to improve the general innervation, if for no other reason than to increase gastric motility; for, when the stomach retains this power, the patient may be expected to do very well, provided a lienteric diarrhea has not developed, and provided the intestinal glands, the liver, and the pancreas are in a healthy state.

*Gastritis of Infancy and Childhood.*—The precise study of the gastric contents in functional disorders of digestion and in gastritis makes easier the interpretation of similar conditions in the very young; and conversely, a good understanding of the gastritis of infants throws light upon the digestive disturbances of adults. Widely different views have been expressed as to the etiology of the stomach-troubles of children, which have of late been practically settled as depending upon fermentative and other changes in milk and other foods—a view that in large part explains the frequency of these disturbances during warm weather. The unprejudiced observer, however, must admit that there is truth in the view that is now in danger of being lost to sight, that teething, worms, cutaneous irritation, phimosis, hyperlithuria, insomnia, and

other events that lead to irritation and depression of the child's nervous system, play an important rôle in bringing about attacks of stomach-trouble. We have so fully appreciated the importance of dietetic defects that the factors just mentioned are being crowded out of view. It is necessary to understand that, no matter how perfect the diet, a child may suffer from serious gastric disturbance merely as a result of a nagging of his nervous system. A child that is not neurotic, and that suffers from no reflex irritation, will be able to manage and thrive upon a really unsanitary diet, as every practitioner has frequent occasion to observe. It is when these two factors, nervous irritation and bad food, are operative at the same time that we have the conditions that will most speedily bring about mischief. In many of these attacks in childhood gastritis is really not present at all, but they are due merely to functional disturbances that are readily converted into acute febrile or afebrile catarrhal gastritis, and this gastritis may become chronic. The truth of this observation will be demonstrated to any one who will take the trouble to examine the stomach-contents of children suffering from gastric disturbances; and a correct management of these disorders will be greatly advanced by the use of the stomach-tube. To this the objection has been urged that the disease is intestinal as well as gastric, and that to correct the state of the stomach is not sufficient. This view is generally a misconception, for, in the beginning, the trouble is gastric; the hepatic and intestinal disorders come about later, when, indeed, they make up an important part of the complex of symptoms.

If, however, the stomach is thoroughly emptied by means of lavage, and the diet is corrected according to information gained by study of the gastric chemistry, and the nervous disturbance is sought out and corrected, it will be found that these disturbances in children will be brief and easily managed, and that the hepatic and enteric aspects of the question will require but little attention. A No. 12 soft catheter, having a large fenestra, should be employed, and from eight to ten inches of the tube should be inserted beyond the lips. Only one or two ounces of sterilized water should be introduced at a time, but the washing should be continued long enough to thoroughly cleanse the stomach; and it is best to employ a little boric acid or hydrogen dioxid in the later washings. Of course enough calomel and castor-oil should be used to assist in the removal of irritative intestinal contents, thus opposing the attendant toxemia that has so much to do with elevation of temperature. The stomach-tube is not likely to become at an early date a popular means of diagnosis and treatment in children, and yet the objections to it are not tenable, as there is no danger attendant upon its use and children object to it far less than might be supposed. There is no reason why children should not receive the benefit of that scientific study of the stomach-contents which is coming to be necessary in similar but far less dangerous conditions in adults. The fatal timidity that leads to the use of opiates, astringents, and the numerous diarrheal mixtures for children, when the real pathology is that of a functional gastric disorder rapidly passing into acute catarrhal gastro-enteritis, must be considered as most pernicious.

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